Final report

Ontario
Waste Management
Corporation

A provincial crown corporation.

DILLON

SITE SELECTION PROCESS

PHASE 4A: SELECTION OF A PREFERRED SITE(S)

SITE SELECTION

VOLUME 1

June 1986

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Consulting Engineers & Planners

OUR FILE: 1106-21-2
YOUR FILE:

26 June 1986

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Attention: Mr. J.G. Micak,
Manager, Environmental Projects

Site Selection Process
Phase 4A: Selection of a Preferred Site(s) -
Site Selection - Volume 1

Dear Sirs:

We are pleased to submit Volume 1 of our two-volume report - Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Site Selection. The report provides the technical documentation of the activities undertaken by a team of site selection consultants in the comparison of eight candidate sites. It also addresses the major reasons for the Phase 4A interpretations and conclusions reached by the site selection team and by the site selection coordinating consultant, M.M. Dillon Limited.

This volume provides background information on the OWMC site selection process and an overview of the Phase 4A approach, including a discussion of such matters as goals and objectives, factors and indicators, roles and responsibilities, study areas and time horizons, and facilities characteristics assumptions. The report describes the four main steps in the refinement of siting options - refinement of site boundaries, access options

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and the location of the physical/chemical treatment plant for partially integrated options. The basic acceptability analysis is also documented in this volume.

Yours truly,

M.M. DILLON LIMITED

DPL:ch
Encl.

David P. Lawrence, M.C.I.P.
Site Selection Manager

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SITE SELECTION STUDY TEAM

The technical coordination of the site selection activities and the preparation of this report was undertaken by David Lawrence, M.E.S., M.C.I.P., subconsultant to M.M. Dillon Limited. Other principle members of the Dillon site selection team included:

Dianne Damman - M.A., M.C.I.P.;
Ann Joyner - M.E.S., M.C.I.P.;
John McCauley - B.E.S.;
Chris Smith - Graphics Coordination
Steve Smith - Graphics Coordination

In addition to the above:

Appendix C, to Volume 1, Rationale for Access Road Impact Zone Employed in the Comparative Evaluation of Options was prepared by John McEwen and John Crosby of M.M. Dillon Limited.

Appendix E, to Volume 2, entitled the Estimate of Composite Economic Base Impacts was prepared by Clayton Research Associates Limited.

Appendix G, to Volume 2, entitled Overview Evaluation of Differences Between Total and Partial Solidification was prepared by Paul Murray, P. Eng., and John McCauley of M.M. Dillon Limited.

Appendix H, to Volume 2 entitled Sensitivity of Transportation Risk Analysis to Inclusion of Receptors Along QEW from Niagara Road 24 to Niagara Road 47 was prepared by John Crosby and Russ Loukes of M.M. Dillon Limited.

Dr. Bryan H. Massam, Professor of Geography and Dean of Research at York University also provided advice regarding evaluation methods.

EXECUTIVE SUMMARY

PREFACE

This executive summary highlights the major points in the two-volume report Site Selection Process - Phase 4A: Selection of a Preferred Site - Site Selection. The purpose of Phase 4A was to provide OWMC with the basis for selecting a preferred site or sites from among eight candidate sites - one in Mississauga (LF-2N), three in Milton (LF-4N, PI-1N, PI-13N), two in West Lincoln (LF-3C, LF-9C) and two in Niagara Falls (LF-1E, PI-27E). These sites were paired into six geographic combinations - LF-4N/PI-1N, LF-4N/PI-13N, LF-1E/PI-27E, LF-1E, LF-3C and LF-9C[1].

Volume 1 provides background information on the OWMC site selection process and an overview of the Phase 4A approach including a description of goals and objectives, factors and indicators, roles and responsibilities, study areas and time horizons, and facilities characteristics assumptions. Volume 1 documents the four elements in the refinement of siting options (i.e. refinement of site boundaries, access road options, rail access options, location of the physical/chemical treatment plant for partially integrated options). The basic acceptability analysis is also documented in this volume. Technical appendices to Volume 1 are bound under a separate cover.

Volume 2 (bound as Part 1 and Part 2) describes the existing environmental conditions at the various candidate sites which may potentially be affected by the OWMC facility. It highlights site-specific design modifications, the process used to identify, refine and rank evaluation factors and the comparative evaluation process. This volume presents four evaluation procedures used to compare the six siting options - a synthesis based upon a review of major differences and tradeoffs using a paired comparison approach, a disciplinary synthesis, and two quantitative aggregation procedures. Volume 2 also documents a series of sensitivity analyses undertaken to determine the sensitivity of the ranking of siting options to alternative assumptions and interpretations. In addition, Volume 2 presents overall conclusions and recommendations. Technical appendices to Volume 2 are bound under separate covers as Part 1 and Part 2.

This report was prepared by the consulting firm of M.M. Dillon Limited (Dillon) on behalf of the Ontario Waste Management Corporation (OWMC). It synthesizes the technical contributions of a number of other site selection consultants. Detailed descriptions of the roles of these other site selection consultants are provided in a series of separate documents listed in the References of this report.

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[1] Site LF-2N was dropped from consideration in an analysis of basic acceptability (Chapter 8, Volume 1).

PURPOSE AND BACKGROUND

This report provides the technical documentation of the role assumed by a team of site selection consultants in the comparison of eight candidate sites.

OWMC has implemented a five-step approach for the selection of an environmentally safe location or locations for its special waste treatment and disposal facilities. These steps are as follows:

Step 1: Narrow the search to a geographic region in Ontario;

Step 2: Identify candidate areas suitable for each facility component within this geographic region;

Step 3: Identify candidate sites within candidate areas;

Step 4: Evaluate candidate sites and select preferred site(s);

Step 5: Test and assess preferred site(s) in detail.

Step 1 is documented in the OWMC Phase 1 (1982) and Phase 2 (1983a) Reports. Step 2 (Phase 3A), the selection of 19 candidate areas within the geographic region is documented in the OWMC Interim Phase 3 Report (1983b) and Step 3 (Phase 3B) is documented in the OWMC Phase 3 Report (1984a and b).

Step 3 is documented in greater detail in a four-volume technical report prepared by M.M. Dillon Limited, entitled Site Selection Process - Phase 3B: Selection of Candidate Sites - Site Selection (1984b). Volume 1 documents the process by which site areas were identified within the candidate areas. Volume 2 documents the procedures employed to identify potential sites within the site areas. Volume 3 documents the process by which the potential sites were compared to produce a short list of candidate sites. The fourth volume, a map portfolio, contains the major maps which support Volumes 1, 2 and 3.

Testing and assessment of the preferred site(s) will be undertaken during Phase 4B (Step 5).

SCOPE AND METHODS

The Phase 4A site selection process was shaped and defined by a series of principles, goals, objectives, factors, study areas, time horizons, and facilities characteristics assumptions. The site selection process involved a team of site selection consultants and OWMC staff. Public and agency review and input were incorporated into each step in the detailed comparative evaluation process. Specific references to public and agency inputs to site selection are made where relevant throughout this report.

The methods employed in each of the steps of the Phase 4A evaluation process pertain to the identification of site selection factors, the collection and analysis of data and the ranking and application of factors to refine and compare siting options.

Site Selection Principles, Goals, Objectives, Factors and Indicators

(a) Principles

A series of principles (Section 2.4, Volume 1), intrinsic to the process of identifying candidate sites, was identified in the OWMC Phase 3 Interim Report (1983b). These principles also apply to the process of refining and comparing the eight candidate sites and include:

- progressive refinement of the search process;
- definition of the environment, i.e. definition used in the Ontario Environmental Assessment Act;
- protection of human health and the environment;
- the involvement of those affected;
- efficiency and effectiveness of the process;
- a second level of protection of the environment;
- likelihood of suitability, i.e. minimizing uncertainty;
- maintenance of choice, i.e. consideration of engineering choices retained or lost.

(b) Goals and Objectives

Three site selection goals were formulated in Phase 3B to guide the process of identifying candidate sites. These site selection goals also apply to the Phase 4A comparison of siting options. These goals, ranked from most to least important, are:

- to minimize risk to human health;
- to minimize environmental impact;
- to minimize financial costs to OWMC and the people of Ontario.

Goals and objectives represent the ends to which the site selection process is directed (Section 2.3, Volume 1). Goals address broad areas of consideration in site selection. Objectives are somewhat more specific.

They represent a refinement and elaboration of goals. In the case of the goal of minimizing environmental impacts, for example, the objectives specify different elements of the environment to be protected. The goals and objectives apply to the entire site selection process.

(c) Factors and Indicators

Factors are the detailed criteria used to compare options in different stages of the site selection process. Factors represent positive or negative considerations which assist in comparing various sets of options. Factors are subdivided into indicators. Indicators were used to identify, describe and predict risks, impacts and costs. In some cases, consultants identified sub-indicators to describe risks, impacts and costs in more detail. These sub-indicators are listed in the individual consultants' reports.

Chapter 4 of Volume 2 documents the factor identification and refinement process, the ranking of risk factors and the ranking of impact factors. In addition, the definition and significance of each factor and the way it was applied are detailed in pertinent report sections in Volumes 1 and 2.

Roles and Responsibilities (Section 2.6, Volume 1)

The site selection team was composed of Dillon Site Selection, a series of risk and environmental impact consultants and an engineering consultant.

The major responsibilities of Dillon's site selection staff, as reflected in this report, included:

- technical coordination of Site Selection team;
- formulation and application of overall evaluation methodology;
- synthesis of site selection team inputs;
- formulation of rationale for and documentation of methodology and synthesis judgements;
- incorporation of inputs to site selection from agencies and the public as obtained through direct contacts, through other members of the site selection team and through the OWMC public consultation activities;
- presentation of synthesis, findings, conclusions and recommendations to the OWMC, agencies and the public as requested by OWMC.

The major responsibilities of the other site selection consultants included the following:

- participation in joint activities of the site selection team;
- data collection, analysis and interpretation;
- integration of inputs from subconsultants, agencies and the public as obtained through direct contacts and through the OWMC public consultation activities;
- synthesis and documentation within disciplines;
- adaptation of overall evaluation methodology to suit data base;
- formulation of rationale for all technical judgements;
- presentation of analyses, findings, conclusions and recommendations to OWMC, agencies and the public, as requested by OWMC.

Additional responsibilities of the engineering site selection consultant, Monenco Limited, in Phase 4A included:

- undertaking engineering analyses including facilities characteristics information, cost, engineering flexibility, events for use in generic risk assessment;
- formulation of suggestions and responses to suggestions, e.g. engineering implications to modify general design and operations to reduce risks, impacts and costs.

The responsibilities of OWMC in the Phase 4A site selection process included the following:

- reaching final decisions regarding the scope and timing of Phase 4A activities (in response to consultants' recommendations);
- reaching final decisions regarding factor identification, factor ranking and refinement, and the comparison of siting options, in response to consultants' analyses and recommendations;
- undertaking public consultation;
- formulating corporate policies, e.g. compensation, mitigation, and review of consultants' outputs in terms of corporate policies and priorities;
- determinating inputs regarding waste quantities, waste characteristics and technology selection;

- coordinating contacts with agencies, media and elected representatives;
- preparing OWMC documents and public statements with technical input from consultants.

Study Areas (Section 2.7, Volume 1)

Six general study areas were identified by the site selection team. These study areas effectively encompass the major risks, impacts and costs which vary among the options under consideration. These study areas are listed and defined as follows:

- site - the site acquisition area boundaries of each candidate site define the on-site study area. Site boundaries were refined in Phase 4A for LF-3C, LF-1E and PI-1N;
- site vicinity - site vicinity refers to the study area around each of the candidate sites used to address major, direct off-site effects on individuals, uses and features. Generally, the site vicinity was defined as approximately 2 km from the centre of each candidate site;
- air dispersion zones - two concentric zones - 0-5 km for fugitive or low level releases and 0-20 km for stack emissions - were defined as being appropriate for the consideration of air dispersion and air quality risks and impacts;
- community and regional - this study area addressed the broader social and economic impacts on the communities and municipalities which encompass the sites;
- access roads - access roads refers to any and all public roadways in Ontario over which truck transport vehicles would haul special wastes, additives and reagents to the candidate sites or between candidate sites. Local and regional access roads refers to that component of the access road system leading from the 400-series highway system to a candidate site or between the two sites which together form a siting option;
- rail access - two impact zones of 170 m and 250 m were identified for purposes of comparing rail access options to each candidate site.

Time Horizons (Section 2.8, Volume 1)

Differences among siting options may vary depending on the time horizon under consideration. Details regarding the treatment of time in Phase 4A are provided in Table 2.4, Volume 1.

Facilities Characteristics Assumptions (Section 2.9, Volume 1)

The Phase 4A facilities characteristics assumptions employed by other members of the site selection team were based on facility characteristics information provided by Monenco Limited with input from various engineering and specialist risk and environmental consultants to OWMC. Other members of the site selection team developed additional assumptions as required by their individual analyses. These facilities characteristics assumptions are highlighted in the Premises section of this summary. A complete listing of these assumptions is provided in Appendix A of Volume 1. Where major potential risks or impacts were identified, consideration was given to the modification of facilities characteristics assumptions.

Site Selection Process

The process of selecting a preferred siting option involved five major steps. An overview of each of these steps is provided below:

Step 1 - Data Collection and Factor Identification

(a) Data Collection and Analysis

The evaluation process began by compiling the Phase 4A data obtained by the individual site selection consultants from such sources as field investigations and on-site testing, interviews with area residents, businesses and municipalities, a "drop-off" survey of residents, reviews of secondary source data (e.g. accident statistics, water well records), and meetings with provincial ministries and agencies. These data were compiled into a series of matrices. In the case of site and site vicinity study areas, the results of the Phase 4A field surveys and testing were compiled into a series of data maps.

Further details on the Phase 4A data collection and analysis are found in the reports of the individual site selection consultants. An overview of the existing environment potentially affected by each set of options is provided in Chapters 4 through 7 in Volume 1 and in Chapter 2 in Volume 2.

(b) Identification of Factors (Section 4.2, Volume 2)

The site selection team established the Phase 4A factors used to evaluate the differences and similarities in potential risks, impacts and costs associated with the establishment of a special waste management facility.

Factor identification and refinement took place in a series of steps (Section 4.2.1, Volume 2). The initial factor list was presented to the public in the OWMC document entitled Phase 4A Factors (OWMC, 1985a).

Refinements to factors took place as a result of public and agency review and input, and as a result of technical review and modification.

The factors employed for each set of options in the refinement of siting options are identified in Chapters 4 through 7 in Volume 1 and Chapter 4 in Volume 2. Chapter 4 in Volume 2 provides a detailed documentation of factor identification, refinement and ranking for siting option comparison. More detailed descriptions of individual factors and of indicators and subindicators which contributed to the factors are provided in the individual consultants' reports.

Step 2 - Refinement of Siting Options

It was necessary to refine the siting options by making decisions on site boundaries, access roads, rail access and the placement of the physical/chemical treatment plant (including solidification plant) with either the incineration plant or the engineered landfill before it was possible to compare siting options.

(a) Refinement of Site Boundaries (Chapter 4, Volume 1)

In Phase 4A revised site boundaries were identified for candidate sites LF-3C, PI-1N and LF-1E. The sites were larger than would be required to accommodate the OWMC facilities. Major site and site vicinity features were delineated in a constraint mapping procedure. Major risk, impact and engineering constraints were used by the site selection team to identify the revised boundaries for each site.

The boundary refinement process took place in three steps. In Step 1, absolute constraints for facility development, such as confining layer thickness, floodprone areas and airport navigational constraint were identified. Areas affected by these constraints were excluded from the site area. Step 2 involved the identification of significant on-site features and resources. Where possible, boundaries were refined to minimize the displacement of these features and resources. In Step 3, off-site features were used to refine site boundaries where on-site features did not clearly result in a preferred revised boundary.

(b) Access Road Options (Chapter 5, Volume 1)

The comparative evaluation of the alternative local and regional access roads for each siting option occurred in two steps:

(i) an initial or preliminary analysis of access roads;

(ii) a more detailed comparative evaluation of the short list of local and regional access road options.

The evaluation process during the initial or preliminary analysis involved the identification and ranking of factors and the compilation of existing data into a series of matrices which highlighted the major differences among the access road options to each site. An overall ranking of access road options was derived. A number of options were then dropped from further consideration.

The second step resulted in the selection of preferred access routes for each siting option. This analysis was based on a much broader range of factors and, consequently, a more detailed data base. Additional information was collected by the individual site selection consultants through interviews with residents and operators of community facilities, a "drop-off" survey of residents, meetings with provincial ministries and agencies, reviews of secondary source materials and roadside field investigations extending 800 metres on either side of the local and regional access roads. The data were compiled in matrices and working maps.

The factors and indicators were ranked according to their relative importance to the minimization of access road risks and impacts. An overall ranking of access road options was derived from a review of the major differences among the options.

(c) Rail Access Options (Chapter 6, Volume 1)

The analysis of rail access options to each site was based on the assumption that rail service is not an absolute requirement for facility operations. Rail service was treated as an opportunity to be realized only if those services offered significant advantages, for example reduced truck volumes, and that these advantages would not be offset by the major impacts and costs associated with rail service. The analysis also assumed that the only economical use of rail service in the foreseeable future would involve the bulk transportation of additives and reagents, such as cement, for the solidification process.

The analysis of rail access options was also conducted in two steps:

(i) the preparation of composite constraint maps to identify rail access options from existing rail lines to the sites;

(ii) a more detailed comparative evaluation of rail access options to each site.

Both steps pertained to the area between the site and the nearest main rail line.

The rail access options analysis began with the identification of a series of transportation, biological, surface water, socio-economic, land use, agricultural and engineering factors. The rail access factors were then ranked in order of importance. The options were compared using summary matrices and composite constraint maps. These matrices and maps served as a basis for identifying and comparing the major tradeoffs associated with the options. Conclusions were based on major differences among options and the relative importance of the factors.

(d) Location of Physical/Chemical Treatment Plant for Partially Integrated Options (Chapter 7, Volume 1)

Among the eight candidate sites, there are 13 facility location possibilities. These possibilities fall under the category of either a fully integrated facility option or a partially integrated facility option.

A fully integrated facility option involves an engineered landfill, a physical/chemical treatment plant (including solidification plant) and an incineration plant, all located on one site. A partially integrated facility option has two sites. It involves a choice of locating the physical/chemical treatment plant at the engineered landfill site or at the incineration plant site.

The choice of locating the physical/chemical treatment plant (including solidification plant) with the engineered landfill or incineration plant involved such considerations as cost and landfill life, transportation risk and impacts, site vicinity risk (as a result of fugitive emissions from the physical/chemical treatment plant), and impacts, such as noise and land use compatibility.

The factors were ranked in order of importance. A preference was established based on a review of the major differences among the options and the factor rankings. A quantitative cross-check of results was then undertaken by factor and factor grouping.

Step 3 - Comparison of Siting Options

The comparison of siting options was divided into two streams of activity - basic acceptability analysis and detailed comparative evaluation.

(a) Basic Acceptability Analysis (Chapter 8, Volume 1)

The basic acceptability analysis addressed severe new constraints identified as a result of the Phase 4A data collection. A constraint was considered severe if it would result in the rejection of a site regardless of the suitability of the site in terms of other factors. Where there was doubt regarding the basis for rejecting a site, the site was retained for further consideration. In this way, no site which had a reasonable potential for being suitable was rejected prematurely.

The basic acceptability analysis began with a review by each consultant of criteria which might warrant further consideration in the basic acceptability analysis. The one criterion retained as a result of this analysis was hydrogeologic natural containment. The application of this criterion took place in two steps - without mitigation, i.e. before design/operations modifications to overcome the constraint, and with mitigation. Separate analyses were undertaken for the engineered landfill and the incinerator physical/chemical treatment plant.

Gartner Lee Associates Ltd. identified major hydrogeologic constraints. These constraints were based largely on the data obtained during Phase 4A from a preliminary drilling program.

Once a constraint was indicated on a site, the engineering consultant, Monenco Limited, developed a list of potential events, however unlikely, in which liquid contaminants could be released. These scenarios concerned such matters as the quantity and type of the release, the location on the site of the release, the residual amount remaining after clean-up, the pathway or potential route for the contamination to reach the surrounding soil (Monenco, 1986). Consideration was given to both short and long-term releases. Following the identification of a potential contaminant source, Gartner Lee Associates Ltd. determined the length of time (breakthrough time) it would take for a contaminant to move through the subsurface to an underlying aquifer.

In the case of the engineered landfill, it was not possible to determine leachate characteristics. It was also not possible to anticipate fully the composition and toxicity of potential contaminants which might be released at the physical/chemical treatment and incineration facilities. A series of conservative assumptions were developed by Gartner Lee Associates Ltd. for purposes of the basic acceptability analysis.

If it appeared that a site might not provide adequate natural containment, site-specific design modifications were undertaken by Monenco. These modifications included adjustments in the depths of excavation and in the placement of facilities on-site. Once these changes were made, Gartner Lee recalculated contaminant breakthrough times and considered again the predictability of geologic conditions.

The revised analysis was then considered in terms of capability to provide natural containment.

(b) Detailed Comparative Evaluation of Siting Options

(1) Design Modifications (Chapter 3, Volume 2)

During the course of Phase 4A, refinements were made to the base case design prepared by Monenco Ltd. at the outset of this phase. In some instances, these changes had important implications for the prediction and interpretation of particular risks, impacts and costs associated with certain siting options.

In addition to the base case changes, the layout of the facility was adjusted on a site-by-site basis. These site-specific refinements assisted in minimizing potential risks, impacts and costs.

Layouts at a scale of 1:10,000 were prepared by the engineering consultant. These layouts were then superimposed on base maps and on the physical settings of the candidate sites to verify whether the base case design could be accommodated. The instances where site-specific changes and/or adaptations were made included (Monenco, 1986):

- restrictions as a result of site features;
- changes required as a result of the size and layout of process areas;
- foundation and structural design changes specific to the load-bearing capacity of each site;
- changes to enhance natural containment potential;
- changes to landfill cell dimensions;
- changes resulting from landfill area restrictions;
- service connections to each site;
- off-site drainage improvements;
- off-site road improvements;
- any additional mitigative measures identified on a site-by-site basis.

(2) Comparative Evaluation

The detailed comparative evaluation of siting options was largely based on the consideration of major issues and tradeoffs between pairs of siting options, taking into account the factor rankings. The following siting options were examined in the detailed comparative evaluation: LF-4N/PI-1N and LF-4N/PI-13N in Milton, LF-3C and LF-9C in West Lincoln, LF-1E and LF-1E/PI-27E in Niagara Falls.

The summary analysis and conclusions of the individual consultants, together with the background data contained in the matrices and working maps, were used to compare the siting options. Concerns and preferences obtained through the OWMC public consultation program also contributed to the ranking of factors and to the identification of issues and tradeoffs.

These analyses enabled the site selection team to identify and to explore more precisely the issues associated with each siting option and the tradeoffs between siting options.

In reviewing the characteristics of the siting options, it became apparent that the differences among siting options within the same geographic cluster were generally less pronounced than the differences among siting options not within the same geographic cluster. It was, therefore, decided first to compare siting options within geographic clusters using a paired comparison approach, i.e. Milton (LF-4N/PI-1N vs. LF-4N/PI-13N), West Lincoln (LF-3C vs. LF-9C) and Niagara Falls (LF-1E vs. LF-1E/PI-27E). A comparison of the preferred options from each cluster was then undertaken. This analysis resulted in a narrowing of the options to a choice between one of the West Lincoln options (LF-9C) and one of the Niagara Falls options (LF-1E/PI-27E).

Step 4 - OWMC Decisions

The OWMC decisions were based on a review of the issues and tradeoffs analysis, both from a study area and a disciplinary perspective. Consideration was also given by OWMC to comments received through the OWMC public consultation program regarding issues and tradeoffs, and to the ranking of factors.

The rationale for the OWMC selection of LF-9C in West Lincoln is contained in the OWMC Phase 4A Report, Facilities Development Process, (OWMC, 1985b).

Step 5 - Confirmation and Recommendations

Subsequent to the OWMC decision, the evaluation was further refined and documented. Four evaluating procedures were employed. Each procedure served as a cross-check to the other procedures. The four procedures are:

- the identification of major differences and tradeoffs between siting options using a paired comparison process (Chapter 5, Volume 2);
- the synthesis of disciplinary perspectives (Chapter 6, Volume 2);
- two quantitative aggregation procedures (Chapter 7, Volume 2).

A further cross-check against all four procedures was a series of quantitative and qualitative sensitivity analyses which assessed if the conclusions would change under alternative assumptions and interpretations.

(a) Differences and Tradeoffs Synthesis (Chapter 5, Volume 2)

The differences and tradeoffs synthesis used to compare and evaluate the six candidate siting options - LF-4N/PI-1N, LF-4N/PI-13N, LF-3C, LF-9C, LF-1E, LF-1E/PI-27E - represents an extension and refinement of the paired comparisons highlighted in the OWMC Phase 4A report (OWMC, 1985d).

The principal characteristics of the differences and tradeoffs synthesis include the following:

- a staged comparison to minimize the amount of data and the number of choices addressed at one time;
- a staged process for each pair of siting options to identify major risks and impacts, to identify major differences between pairs of options and to evaluate tradeoffs between options;
- a staged process for comparing pairs of options;
- the use of data and interpretations derived from the site selection consultants' technical analysis;
- the systematic incorporation of public and agency concerns into the comparison process;
- the presentation of the synthesis by means of a series of reasoned arguments supported by data and interpretation summarized in tabular form.

The process of comparing the siting options took place in three steps - the comparison of siting options within geographic clusters, the comparison of the preferred siting options from each geographic cluster and the final comparison of the two most preferred siting options.

(b) Synthesis of Disciplinary Perspectives (Chapter 6, Volume 2)

In Phase 4A each consultant was responsible for synthesizing their analyses and interpretations and for ranking the siting options. This ranking procedure gave each consultant the opportunity to derive an overall disciplinary/professional perspective. Chapter 6 of Volume 2 integrates the disciplinary/professional perspectives of the individual site selection consultants.

The disciplinary integration process was split into two streams of activities - one concerned with risks to human health and the other with environmental impacts. In both activity streams, the process began with the rationale for the ranking of siting options prepared by the consultants, together with the overall ranking of factors. Once overall risk and impact siting option rankings were derived, the tradeoffs among the risk, impact and engineering cost and flexibility rankings were evaluated.

In evaluating the various arguments for and against different positions, the following distinctions were made: absolute risks and impacts, relative risks and impacts, mitigation potential, uncertainty, policy and factor rankings.

(c) Quantitative Aggregation of Factors (Chapter 7, Volume 2)

In the quantitative aggregation procedures, site selection risks and impacts were combined or aggregated by summing the products of factor rankings and factor suitability levels.

The quantitative aggregation process began with a review of the procedures employed by the consultants to combine their indicator and factor rankings with their indicator and factor suitability levels. A number of adjustments were made to ensure consistency and for the combining of impact factors on a study area and a disciplinary basis.

Risks were aggregated by risk pathway. Impacts were aggregated by both study area and discipline. The initial step in each case was the calculation of a hypothetical best siting option. The hypothetical best siting option is the sum of the best factor suitability levels for the most preferred siting option for all factors. It served as a bench-mark against which the siting options could be compared.

Factor suitability levels and factor rankings were then aggregated. For example, risk factors were aggregated for each risk pathway by summing products of factor ranking and suitability level (i.e., factor scores) and by dividing by the number of factors for each siting option. Reasonable error limits of 1% and 5% of the mean factor scores were applied to the factor scores. The resulting numbers were displayed in graph form. The results derived by the individual consultants were cross-checked. Finally, overall conclusions were derived.

(d) Sensitivity Analyses (Chapter 8, Volume 2)

A large number of sensitivity analyses were undertaken to determine the sensitivity of siting option rankings to alternative assumptions and interpretations. These sensitivity analyses represented a cross-check of interpretations and conclusions addressed in factor ranking (Chapter 4, Volume 2) and in siting option comparison (Chapters 5, 6 and 7, Volume 2).

The sensitivity analyses, where possible, extended from the quantitative aggregation of factors (Chapter 7, Volume 2). Not all sensitivity analyses were addressed quantitatively. In a number of instances, it was only possible to adjust siting option rankings or the differences between siting options in a qualitative fashion.

(e) Conclusions and Recommendations (Chapter 9, Volume 2)

The final step in the confirmation analysis was the formulation of conclusions and recommendations. The results of the various evaluation procedures were compared and conclusions formulated regarding the ranking of siting options. The recommendations pertained to suggested refinements and additional analyses, as well as to possible mitigative and compensation measures.

PREMISES

Facilities Characteristics Assumptions (Section 2.9, Volume 1)

The facilities characteristics assumptions used in the Phase 4A site selection were based on the facility characteristics information provided by Monenco Limited and OWMC. Other members of the site selection team developed additional assumptions as required by their individual analyses. The work undertaken by Monenco Limited regarding facilities characteristics information is documented in Site Selection Process - Phase 4A: Selection of a Preferred Site(s) Engineering (Monenco, 1986).

Some of the key facilities characteristics assumptions employed in Phase 4A site selection process included the following:

- the initial OWMC treatment facility will treat 150,000 t/a of incoming waste, and is capable of expansion to treat 300,000 t/a by the year 2001;
- the opening date for the OWMC facility is assumed to be 1991;
- facility composed of a conventional landfill, an incineration plant (stack height between 60 and 100 metres) and a physical/chemical treatment plant (including solidification plant); facility components arranged as either integrated (all three components at one site) or partially integrated (physical/chemical treatment plant including solidification plant located with incineration plant with separate landfill or physical/chemical treatment plant including solidification plant located with landfill with separate incinerator) siting option;
- total solidification of residue from physical/chemical treatment of inorganics and thermal destruction of organic wastes; only treated solidified residues placed in landfill, i.e. no discharge of process water to stream or lakes;
- facility size is as follows:
    - Case 1 (integrated) - 17.4 ha central operating area;
    - Case 2 (separate landfill) - 17.7 ha central operating area;

- ° Case 3 (separate incineration plant) - 10.7 ha incineration plant operating area;
- ° Case 3 - 10.2 ha physical/chemical treatment plant operating area;
- ° LF-9C - 19.9 ha central operating area.

o site sizes are as follows:

- ° LF-1E - 273 ha (integrated), 135 ha (partially integrated);
- ° PI-27E - 188 ha;
- ° LF-3C - 206 ha;
- ° LF-9C - 135 ha;
- ° LF-4N - 168 ha;
- ° PI-1N - 175 ha;
- ° PI-13N - 170 ha;
- ° LF-2N - 172 ha.

o these site sizes include a buffer zone of 50 m from the property boundary to the outside perimeter of landfill cells and 400 m from the point of fugitive emissions from treatment facilities;

o treatment will involve the thermal destruction of organic wastes; there will be a single incinerator site; incineration plant ultimate capacity is assumed to be 60,000 tonnes per year; general operating characteristics and appearance of the incinerator are comparable to a medium to heavy industrial use;

o treatment will involve the physical/chemical treatment of inorganic wastes; there will be a single physical/chemical treatment plant; physical/chemical ultimate capacity is assumed to be 240,000 tonnes/year; general operating characteristics and appearance of the physical/chemical treatment plant are comparable to a medium industrial use;

o the conventional landfill will be designed and operated in a way which will minimize the formation of leachate and its release into the surrounding environment. A detailed monitoring network will be provided and mitigation will be prepared to deal with any problem that may be revealed by the monitoring;

o during the disposal operations, waste residues will be placed in individual cells of limited capacity. This procedure will ensure that the working area is of manageable size and that the facility design can be modified to accommodate future technological advances and contingency plans. It will also help to minimize the quantity of contaminated drainage resulting from precipitation falling on the open cells;

o the facility is not expected to have impacts on residents with respect to odour and dust beyond the 2 km zone;

- the source of emissions is within the central operating area;
- incinerator stack and fugitive emissions will adhere at least to provincial standards. Generally emissions are expected to be well below those permitted under MOE regulations;
- trucking operations will be limited to regular (7 a.m. to 5 p.m.) daylight hours on a five day schedule (Monday to Friday) with no regularly scheduled night-time and weekend deliveries; assume 180 vehicles per day (two way movements) for the movement of all waste, reagents and additives and process by-products at the ultimate plant capacity;
- all special waste will arrive by road transport only; rail transport of additives and reagents was only viewed as an opportunity.

Other Site Selection Consultants

This report synthesizes the site selection activities of a team of consultants specializing in hydrogeology, hydrology, biology, agriculture, social analysis, economic analysis, municipal finance, land use, air dispersion and air quality, transportation, engineering and risk assessment. The references for the technical reports prepared by these consultants are listed in Volume 1 of this report.

Public Consultation

The public comments and concerns considered during the Phase 4A site selection process were obtained from the public consultation program formulated and managed by OWMC, in consultation with the site selection consultants. The site selection team participated in the development and implementation of those components of the OWMC public consultation program which pertained to site selection.

Emergency Response

It was assumed that OWMC will provide adequate emergency response capability irrespective of where the facility is located. It was further assumed, for purposes of site selection, that emergency response capability is equal (or will be made equal) for all siting options.

Local Benefits and Compensation

In Phase 4A, OWMC indicated that no municipality would suffer financially. It was also assumed that no spin-off industries will locate near the preferred site due to the availability of the OWMC facilities, waste products or related services.

Basis for Decision-Making

The evaluation procedures documented in this report are intended to facilitate decision-making. The product of these procedures are not decisions. Such decisions have been made by the OWMC, based in part on the evaluation of the technical analyses undertaken, but also upon a broader sense of provincial and community needs and desires.

It is recognized that OWMC must consider a range of other matters beyond the scope of this report which may also influence its preferences and decisions. Such matters include, for example:

- timing implications for facility development - specifically the cost to the province of delaying a decision on the preferred site;
- differences in potential ease of approvals;
- corporate policy implications, e.g. mitigation, monitoring, compensation;
- residual uncertainties associated with the selection of particular options and the corporate implications of selecting a site which possesses such uncertainties;
- agency and public inputs received by OWMC external to the site selection process.

POSTULATES

The site selection goals, objectives and principles guided and shaped the Phase 4A site selection process.

The general approach employed in the use of facilities characteristics assumptions was to focus on those characteristics which would influence the relative suitability of the candidate sites. It was considered desirable to maintain a degree of flexibility in the facilities characteristics. In this way design and operational modifications could be introduced in conjunction with design and operational refinements.

The retention of a degree of flexibility in the identification of facilities characteristics also allowed for refinements in the analysis of waste quantities, characteristics and distribution and in the evaluation of technological and operating options.

A step-by-step approach to evaluation was used. In this way, the range of options and considerations bearing on choices at any one step was limited and more understandable. Each successive step extended from the previous step.

Choices were evaluated at a level of detail consistent with decision-making requirements. A broad level of detail was sufficient for the refinement of siting options and basic acceptability choices. A somewhat greater level of detail was necessary to compare the final six siting options. Depending on the way in which the array of information and interpretations associated with the detailed comparative evaluation of siting options is integrated, conflicting conclusions could be reached. In order to allow for such variations, two qualitative and two quantitative evaluation procedures were employed.

Each of the procedures possesses various strengths and limitations. Many of the limitations of one procedure represent strengths of one or more of the other procedures. Thus, the procedures served as cross-checks against one another. A series of quantitative and qualitative analyses were also undertaken which tested the sensitivity of conclusions derived from the other procedures to alternative assumptions and interpretations.

Each of the evaluation procedures employed in the various stages of the Phase 4A site selection process:

- builds upon the consultants' data, analyses, interpretations and conclusions;
- draws upon the judgements and interpretations reached through factor identification, refinement and ranking;
- directly or indirectly incorporates agency and public inputs;
- represents a step-by-step evaluation procedure. Each step in the process is detailed, including relevant definitions, judgements and conclusions.

The evaluation process is presented in a manner such that:

- the application of the evaluation procedure or procedures employed is detailed;
- an explicit evaluation process is provided in order that reviewers can understand the basis for judgements made during each stage of the process;
- all the major items of information and interpretation employed in the evaluation process are presented;

- value judgements are made explicit and the bases for those judgements are substantiated;

- cross-referencing to support materials and the technical reports of other consultants is facilitated;

- the points at which agency and public concerns were incorporated into the evaluation process are indicated.

Extensive use is also made of figures, summary tables, appendices, introductory and concluding sections to facilitate review and understanding.

STATUS OF DATA

The data employed in Phase 4A were obtained from a number of sources including field investigations and on-site testing, interviews with area residents, businesses and municipalities, a "drop-off" survey of residents, reviews of secondary source data (e.g. accident statistics, water well records), and meetings with provincial ministries and agencies. In addition, a number of OWMC public workshops and meetings were held to obtain input at key points in the Phase 4A site selection process.

Public and agency comments and reactions were requested through public consultation activities designed for a specific purpose (e.g. public and agency review of preliminary Phase 4A factors and factor rankings). Public and agency inputs were obtained through the review of submissions made to the OWMC during Phase 4A and a review of records of meetings held among the public, agencies, site selection consultants and OWMC staff. In addition, the site selection consultants met with the public and agency representatives individually and, in the case of the public, through workshops. The consultants incorporated public and agency input into their individual analyses. Public and agency input was also incorporated in the overall Phase 4A analyses, as documented in this report.

Further details on the Phase 4A data collection and analysis are found in the reports of the individual site selection consultants. Specific sections on data collection and analysis are also provided in Chapters 4 to 7 in Volume 1.

FINDINGS

Refinement of Siting Options

(a) Refinement of Site Boundaries

The site boundaries for LF-3C, LF-1E and PI-1N were refined. Some flexibility was allowed for facilities development, should further constraints be identified.

For site LF-3C, two sections of the site, in the northeast and northwest corners, were eliminated. This decision was principally based on the consideration of flooding constraints. The remaining site area was required for a 20-year landfill life and operations area. No major constraints were identified for the remaining area.

A major hydrogeologic constraint was identified for the southeast portion of LF-1E. Of the remaining area, a minimum of the north half of the site was required for partially integrated facilities development. A site boundary for the partially integrated siting option was defined south of Young Road. For the fully integrated option, the original Phase 3B area was required for facilities development and landfill.

For PI-1N, a navigational constraint between the incinerator stack and Burlington Airpark was identified. This constraint reduces the potential site area to the east half of PI-1N. Of the remaining area, the southeast quarter was marginally preferred based on social, agricultural, surface water and land use constraints.

(b) Access Road Options

In the preliminary Phase 4A analysis of local and regional access road options, preferred options were identified for LF-9C, PI-1N to LF-2N, PI-13N to LF-2N and LF-4N. These options were selected as the basis of a review of the major issues and tradeoffs identified for each access road option and a quantitative cross-check.

The second level of analysis, or the Phase 4A analysis of access road options, resulted in the selection of preferred access routes for the remaining siting options. The Phase 3B intersite transfer route between PI-1N and LF-4N was also re-examined and a new preferred route was selected. These options were selected using a similar methodology to that employed in the preliminary Phase 4A analysis of access road options.

The preferred access routes for each siting option, selected in either Phase 3B or Phase 4A, were carried forward to the detailed comparative evaluation of siting options.

(c) Rail Access Options

Rail access options were identified for candidate sites LF-4N, PI-1N, LF-3C, LF-9C, LF-1E and PI-27E through the constraint mapping exercise. In the case of LF-2N and PI-13N, major impacts were associated with the provision of rail service. Before eliminating rail access as an opportunity at this stage of the analysis for these two sites, two additional transportation factors (construction cost and road crossings) were identified and applied. The site selection team concluded that rail service was not an opportunity at LF-2N and PI-13N. This conclusion was based on the review of major impacts and costs associated with the provision of rail to these sites.

Four rail access options were identified for LF-4N. Option 1 was selected as the preferred option because it has no social or land use impacts and required a minimum rail spur line.

Four rail access options were identified for PI-1N. Option 2 was selected as the preferred option. It has no social or land use impacts, no farm severances or farm buildings in close proximity, no surface water features crossed and is the highest ranked option in terms of transportation safety.

Three rail access options were identified for LF-3C. Option 2 was selected as the preferred option. It has no social or land use impacts, no farm severances or farm buildings in close proximity, no natural environment constraints and no surface water constraints.

Five rail access options were identified for LF-9C. Option 4 was selected as the preferred option. It has few residents within 250 m, no farm severances and only one commercial facility within 250 m.

Four rail access options were identified for LF-1E. Option 1 was selected as the preferred option. It has few farm residences within 250 m, no farm severances and only one commercial facility within 250 m.

One rail access option was identified for PI-27E. No on-site impacts, with the exception of cost, are associated with this option.

(d) Location of the Physical/Chemical Treatment Plant for Partially Integrated Siting Options

Two options were available for the location of the physical/chemical treatment plant for partially integrated siting options, either with the incineration plant or with the landfill site. The preferred location was determined by comparing the options based on risk, impact and engineering factors. The methodology included the screening, ranking and aggregation of factors. Two cross-checks of the results were also undertaken.

In all three cases (LF-1E/PI-27E, LF-4N/PI-13N and LF-4N/PI-1N), the preferred location for the treatment plant was with the incinerator (PI) site.

Basic Acceptability

(a) LF-2N

The hydrogeologic analysis of LF-2N revealed that the excavation for the landfill (to a depth of 10 metres) would intersect directly with the aquifer. The contaminant breakthrough times for portions of the site were therefore zero. In effect, this meant that the site would not provide a second level of protection. Leachate from the landfill could be expected to discharge directly into the underlying aquifer without the benefits of attenuation afforded by the confining layer (Gartner Lee Associates, 1985a).

In an effort to mitigate this constraint, the design of the landfill was modified to limit the excavation depth to 5 m. The modifications to the landfill excavation depth did not, however, enhance the natural containment potential of LF-2N.

As a result of its failure to provide natural containment, the consultants involved in the analysis recommended that LF-2N be dropped from further consideration. OWMC accepted this recommendation in May, 1985.

(b) LF-4N

The hydrogeologic analysis of LF-4N, in terms of its suitability for a landfill, indicated that the confining layer would not be completely penetrated by a 10 m deep excavation. Hence, the site did offer some natural containment. With contaminant breakthrough times ranging from 1 to 68 years, however, there were serious concerns regarding the adequacy of the natural containment provided. There was also some concern that detailed drilling might identify conditions indicating the site offered negligible natural containment. It was, therefore, decided to attempt to enhance the natural containment potential of LF-4N through design modifications. By limiting development to those portions of the site where the confining layer exceeded 15 m, breakthrough times of 45 to 68 years were estimated. However, limiting development to the area exceeding 15 m meant that an excavation depth of 10 m was required to ensure a reasonable landfill life.

Although LF-4N was characterized as possessing marginal natural containment potential, the site was basically acceptable. This conclusion also recognized the conservative assumptions employed in the analysis.

(c) PI-13N

The engineering analysis indicated that there was potential for aqueous short-term releases which might not be fully possible to clean up. More importantly, the potential for small, but long-term releases, remaining undetected until after decommissioning, was identified. As a result, it was concluded that the OWMC policy of natural containment for the incinerator/physical/chemical treatment plant was warranted in the interest of minimizing risk to human health. The PI sites were, therefore, subjected to a basic acceptability analysis comparable to that applied to the landfill sites.

When the basic acceptability screen was applied to PI-13N (assuming an excavation depth of 8 m), it was determined that the excavation would locally penetrate the aquifer under the subsurface leak scenario. Thus, the site did not provide natural containment. Raising the depth of excavation for the central operating area from 8 m to 5 m did not alter the constraint identified at PI-13N. It was therefore concluded that PI-13N failed to provide natural containment. As a result, it was recommended that PI-13N be considered basically unacceptable. The conclusions regarding PI-13N were not reached until the detailed comparative evaluation was virtually complete. PI-13N, in combination with LF-4N, has therefore been included in the detailed comparative evaluation analysis.

(d) PI-1N

When the basic acceptability screen was applied to PI-1N (assuming an excavation depth of 8 m), it was determined that the excavation would locally penetrate the aquifer under the subsurface leak scenario. Thus, with an 8 m excavation, PI-1N potentially offered no natural containment.

By raising the depth of excavation for the central operating area to 5 m for PI-1N, it was determined that the confining layer would not be completely penetrated. Thus, the site provided some natural containment. It was concluded that PI-1N was basically acceptable, although from a hydrogeologic perspective, the site could be characterized as marginal.

(e) Other Sites

All the remaining landfills (LF-3C, LF-9C, LF-1E) and the remaining PI site (PI-27E) were considered basically acceptable. They were therefore retained for consideration in the detailed comparative evaluation.

Detailed Comparative Evaluation

(a) Differences and Tradeoffs Synthesis (Chapter 5, Volume 2)

In the differences and tradeoffs synthesis, pairs of siting options were initially compared within geographic clusters, e.g. Milton, West Lincoln, Niagara Falls. Comparisons of preferred siting options from each geographic cluster were then made. A cross-check was also undertaken between LF-9C and LF-1E. The results of these analyses were as follows:

The paired comparisons with siting options within geographic clusters resulted in the following conclusions:

i) Milton:	LF-4N/PI-1N is clearly preferred over LF-4N/PI-13N with respect to risks and impacts. This conclusion is also supported by engineering considerations although the differences are slight.
ii) West Lincoln:	LF-9C is marginally preferred over LF-3C for risks. LF-9C is clearly preferred over LF-3C for impacts. There are no appreciable engineering differences between the two options.
iii) Niagara Falls:	LF-1E is slightly preferred over LF-1E/PI-27E for risks. There is a clear preference for LF-1E/PI-27E for impacts. There is a slight engineering preference for LF-1E. Overall the clear impact differences more than offset the slight risk and engineering differences. The overall differences, are however, limited and could be subject to conflicting interpretations.

The paired comparisons of siting options among geographic clusters resulted in the following conclusions:

i) Milton: (LF-4N/PI-1N) vs. West Lincoln (LF-9C)	LF-9C is preferred to LF-4N/PI-1N for both risks and impacts. There is a clear preference for LF-9C for risks. The preference for LF-9C for impacts is moderate. There are no appreciable engineering differences between the two siting options.
ii) Milton: (LF-4N/PI-1N) vs. Niagara Falls (LF-1E/PI-27E)	LF-1E/PI-27E is clearly preferred over LF-4N/PI-1N for both risks and impacts. The slight cost and flexibility differences favouring LF-4N/PI-1N are not sufficient to alter this preference.

iii) West Lincoln: (LF-9C)[1] vs. Niagara Falls (LF-1E/PI-27E	LF-9C is clearly preferred over LF-1E/PI-27E for risks. LF-1E/PI-27E is clearly preferred over LF-9C for impacts. There is a slight engineering preference for LF-9C. A case can be made for the selection of either siting option. The selection of the preferred option is dependent on the relative importance attached to risks and impacts in general and on the interpretations of particular risk, impact and cost/flexibility considerations associated with the two options.

The cross-check between LF-1E (Niagara Falls) and LF-9C (West Lincoln) resulted in the following conclusions:

- LF-9C is clearly preferred over LF-1E for risks. LF-1E is clearly preferred over LF-9C for impacts. In both cases, the differences between LF-9C and LF-1E are more limited than those between LF-9C and LF-1E/PI-27E. There is a slight engineering preference for LF-9C.
- As in the previous comparison, the choice of a preferred siting option is dependent on the importance attached to risks and impacts in general as well as on interpretations of the individual risks and impacts associated with the two siting options.

(b) Synthesis of Disciplinary Perspectives (Chapter 6, Volume 2)

The disciplinary synthesis was split into two streams of activities - one concerned with risks to human health and the other with environmental impacts. Once overall risk and impact siting option rankings were derived, the tradeoffs among the risk, impact and engineering cost and flexibility rankings were derived. The results of these analyses are as follows:

The siting options are ranked from most to least preferred for risk as follows:

1. LF-9C;
2. LF-1E;
3. LF-3C and LF-1E/PI-27E;
4. LF-4N/PI-1N;
5. LF-4N/PI-13N.

LF-4N/PI-13N is considerably less desirable than the other five options. A fairly broad gap occurs between LF-4N/PI-1N and the four most highly ranked options. The four most highly ranked options are all clustered quite close together in terms of attractiveness.

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[1] OWMC concluded that LF-9C was preferred over LF-1E/PI-27E as indicated in the OWMC Phase 4A report, (OWMC, 1985b).

LF-9C is the preferred siting option, from a risk perspective. The comparison between LF-9C and LF-1E, LF-9C and LF-1E/PI-27E, and LF-9C and LF-3C resulted in a clear preference for LF-9C. The differences among the remaining three siting options (i.e., LF-3C, LF-1E and LF-1E/PI-27E) are very limited. The LF-1E - LF-1E/PI-27E comparison resulted in a slight preference for LF-1E. The LF-1E - LF-3C comparison resulted in a slight preference for LF-1E. The differences between LF-3C and LF-1E/PI-27E were too limited to indicate a clear preference. The ranking of the top options involves many difficult interpretations and tradeoffs.

The siting options are ranked from most to least preferred for impacts as follows:

1. LF-1E/PI-27E;
2. LF-1E;
3. LF-9C;
4. LF-4N/PI-1N and LF-3C;
6. LF-4N/PI-13N.

There is a wide gap between the fourth (LF-4N/PI-1N and LF-3C) and sixth (LF-4N/PI-13N) ranked options. There is quite a wide gap between the third (LF-9C) and fourth (LF4N/PI-1N and LF-3C) ranked options.

The differences among the top ranked options are moderate. The rankings involve some difficult interpretations and tradeoffs. The differences among the top ranked options are somewhat dependent on the importance attached to the industrial designation of PI-27E.

The six siting options were placed into two tiers for the purpose of combining risk and impact rankings:

- Tier 1 - composed of LF-9C, LF-1E and LF-1E/PI-27E;
- Tier 2 - composed of LF-3C, LF-4N/PI-1N and LF-4N/PI-13N.

The only tradeoff in Tier 2 is between LF-3C and LF-4N/PI-1N. LF-3C is ranked third for risks and fourth for impacts. LF-4N/PI-1N is ranked fourth for risks and impacts. In view of the higher ranking of LF-3C for risk, there is a clear preference for LF-3C over LF-4N/PI-1N.

Tier 1 involves a three-way comparison of LF-1E, LF-9C and LF-1E/PI-27E. With the LF-1E versus LF-1E/PI-27E comparison, a great deal depends on the importance attached to the industrial designation of PI-27E. In the final analysis, the industrial designation of PI-27E is treated as a significant consideration. As a result, the moderate impact differences favouring LF-1E/PI-27E more than offset the minor risk differences favouring LF-1E.

Both the LF-1E versus LF-9C and the LF-1E/PI-27E versus LF-9C comparisons involve difficult choices. An overall preference is dependent on interpretations of the collective arguments for and against the three siting options.

Ultimately, the choice among the three options depends on interpretations of:

- the magnitude and significance of individual risks and impacts associated with each option;
- the magnitude and significance of the overall risk differences favouring LF-9C over LF-1E;
- the magnitude and significance of the risk differences favouring LF-9C over LF-1E/PI-27E;
- the magnitude and significance of the overall impact differences favouring LF-1E/PI-27E over LF-1E and LF-9C;
- the magnitude and significance of the overall impact differences favouring LF-1E over LF-9C;
- the relative importance of risks as compared to impacts.

The inclusion of costs did not affect the overall ranking of siting options. Inasmuch as the cost spread among the options is less than the level of accuracy of the cost estimates, the engineering consultant concluded that, "the cost factor should be given low importance in the selection of a preferred site(s)" (Monenco, 1986, p.156).

The engineering consultant also indicated that the differences in flexibility between siting options is not viewed as a major constraint. To the extent that differences do exist in the Tier 1 comparison, LF-9C is favoured over LF-1E and LF-1E/PI-27E. LF-9C can accommodate both a conventional and a shallow entombed landfill design. The Niagara Falls options can only accommodate the conventional landfill design. LF-9C also possesses greater potential for the expansion of landfill area.

(c) Quantitative Aggregation of Factors (Chapter 7, Volume 2)

The quantitative aggregation procedure involved summing the products of factor rankings and factor suitability levels. Risks were aggregated by risk pathways. Impacts were aggregated by both study area and discipline.

When risk factors are aggregated by pathway and impact factors by study area, the following ranking results, including 1% error:

1. LF-1E;
2. LF-1E/PI-27E and LF-9C;
3. LF-3C;
4. LF-4N/PI-1N;
5. LF-4N/PI-13N.

When a 5% error is applied LF-1E, LF-1E/PI-27E and LF-9C are essentially equal. LF-3C is less attractive than the Niagara Falls options, but overlaps with LF-9C. Similarly, LF-4N/PI-1N is less attractive than the Niagara Falls options and LF-9C, but overlaps with LF-3C. LF-4N/PI-13N is clearly least preferred.

When impact and risk factors are aggregated by discipline/pathway and based on a 1% error estimate, the following ranking results:

1. LF-9C;
2. LF-1E and LF-3C;
3. LF-1E/PI-27E;
4. LF-4N/PI-1N;
5. LF-4N/PI-13N.

When a 5% error is applied, the Niagara Falls and West Lincoln options are not significantly different, although LF-1E/PI-27E is less attractive than LF-9C. The two Milton options are clearly less preferred. LF-4N/PI-13N is clearly less preferred than LF-4N/PI-1N.

After reviewing the quantitative aggregation, the following was concluded:

- The two Milton siting options are least preferred.

- The differences among the four remaining siting options are quite limited. The selection of a preferred siting option, from among these siting options, is dependent upon such considerations as:

  - the method of aggregation employed;
  - the weight placed upon individual risks and impacts;
  - the weight placed upon risks as compared with impacts.

- In view of the potential for varying many of the inputs into the quantitative aggregation, it would be preferable to consider the top four ranked siting options further on the basis of a range of sensitivity analyses.

(d) **Sensitivity Analysis** (Chapter 8, Volume 2)

A large number of analyses were undertaken to determine the sensitivity of siting option rankings to changes in assumptions and interpretations. The results of these analyses follow:

- The two Milton siting options are highly insensitive to changes in assumptions and interpretations. Both the qualitative and the quantitative sensitivity analyses reinforce the conclusion that the Milton siting options are clearly less desirable than either the West Lincoln or Niagara Falls siting options.

- The qualitative sensitivity analyses do not alter siting option rankings. The West Lincoln siting options are favoured over the Niagara Falls siting options in their suitability for either a conventional or a shallow entombed landfill technology and when greater weight is attached to direct air risks. The future scenarios, haul methods, secondary access routes and ability of communities to cope with change slightly shifts the overall preference towards the Niagara Falls siting options.

- The same direction of change, with respect to the ranking of siting options, results from both quantitative aggregation procedures. However, the resultant siting option rankings are not always the same for the two aggregation procedures.

- The quantitative risk sensitivity analyses generally favour the West Lincoln siting options. The preferred position of LF-9C for the aggregation by disciplines procedure is unchanged by the risk sensitivity analyses. LF-9C is ranked first before the sensitivity analyses are applied. The ranking of LF-9C changes for sensitivity analyses for aggregation by study area (from third to second and first). Similarly, with one exception (the deletion of the ground and surface water factors) the preferred first ranking of LF-1E for the study area aggregation procedure is unchanged by the risk sensitivity analyses. For the aggregation by discipline procedure, LF-IE is reduced in ranking from second to third in several cases.

- The limited differences between LF-3C and LF-1E with the disciplinary procedure and between LF-9C and LF-1E/PI-27E with the study area procedure are reflected in a range of values for risk sensitivity analyses which reverse the ranking of these options in favour of the West Lincoln options. The one exception is that the attachment of greater significance to flooding constraints reduces the position of LF-3C.

- The quantitative impact sensitivity analyses generally favour the West Lincoln and LF-1E/PI-27E siting options. The preferred position of LF-9C, for the aggregation by disciplines procedure, is unchanged by the impact sensitivity analyses where LF-9C is ranked first prior to the application of the sensitivity analyses. The ranking for LF-9C improves for several of the aggregation by study area sensitivity analyses. The first ranking position of LF-1E over LF-9C, for the study area aggregation, is reversed when the local and regional access roads are redefined. The preferred position of LF-1E over LF-1E/PI-27E, for the study area aggregation procedure, is reversed when greater importance is attached to the industrial designation of PI-27E or if on-site impacts are assumed mitigable.

- The limited differences between LF-3C and LF-1E with the disciplinary procedure and between LF-9C and LF-1E/PI-27E with the study area procedure are again reflected in a range of impact sensitivity analyses which reverse the ranking of these options.

CONCLUSIONS (Chapter 9, Volume 2)

The following conclusions pertain to the comparative evaluation of the six siting options - LF-4N/PI-1N and LF-4N/PI-13N in Milton, LF-3C and LF-9C in West Lincoln, and LF-1E and LF-1E/PI-27E in Niagara Falls.

Milton Siting Options

The Milton siting options are clearly less suitable than the other four siting options. This pattern is maintained across all evaluation procedures. It is also reflected in the limited sensitivity of the ranking of the two options to changes in assumptions and interpretations.

Of the two Milton siting options, LF-4N/PI-13N is less suitable. Moreover, as discussed in Chapter 8 in Volume 1, LF-4N/PI-13N fails to ensure natural containment. As a result, LF-4N/PI-13N is basically unacceptable.

LF-3C in West Lincoln

Of the four remaining options, LF-3C is the least preferred. The major reasons for this conclusion include the following:

- LF-3C is the least desirable siting option from a transportation and flood susceptibility risk perspective. LF-9C shares LF-3C's natural containment and air risk advantages. However, LF-9C fails to share, to the same extent, its transportation and surface water risk disadvantages.

- LF-3C is ranked fourth overall for impacts in the disciplinary synthesis and in the quantitative aggregation by discipline. LF-3C is ranked sixth overall for impacts in the quantitative aggregation by study area. LF-9C is preferred to LF-3C in the differences and tradeoffs synthesis.

- LF-3C is ranked third or fourth in the quantitative aggregation by study area for site, site vicinity and community and regional impacts. It is ranked sixth in the quantitative aggregation for access road impacts.

- LF-3C is ranked as the least desirable siting option by the agriculture and social consultants. It is also ranked fourth overall by the land use, economic base and biology consultants. Of the impact consultants, LF-3C is only highly ranked by the municipal finance and air impact consultants. Municipal finance and air impacts involve moderately ranked factors. In both cases, these advantages are also possessed by LF-9C. However, LF-9C does not possess, to the same extent, the impact disadvantages associated with LF-3C.

LF-9C in West Lincoln and LF-1E and LF-1E/PI-27E in Niagara Falls

The choice among these three siting options involves some difficult tradeoffs and interpretations. The limited differences across the options are reflected in the different results which emerge, depending on the synthesis or aggregation procedure employed. It is also evident in the ranking variations which occur when different sensitivity analyses or combinations of sensitivity analyses are employed. The major advantages of each of these siting options are highlighted in Table 9.2 in Chapter 9. A much more detailed description of the advantages and limitations of these three siting options is presented in Chapters 5 and 6 of Volume 2. The final choice depends on the importance attached to the collective strengths and limitations associated with each of the three siting options.

RECOMMENDATIONS (Chapter 9, Volume 2)

The Ontario Waste Management Corporation has selected LF-9C (OWMC, 1985b) as its preferred siting option. Table 9.3 in Chapter 9 contains a detailed series of recommendations concerning suggested refinements and additional analyses and possible mitigative and compensation measures. The recommendations are specific to site LF-9C. They represent a consolidation of the recommendations of the individual site selection consultants, together with those of the site selection coordinating consultant, M.M. Dillon Limited.

The suggested refinements and additional analyses are directed towards reducing potential areas of uncertainty, and in providing the data bases for risk and impact management and monitoring. In considering potential refinement and additional analyses, more detailed analyses for their own sake, are not desirable. Such analyses should only be undertaken where they can be linked to such objectives as:

- the confirmation of site acceptability;
- the resolution of areas of uncertainty pertinent to potential risks and impacts;
- the formulation and institution of mitigative and/or compensation measures;

- the provision of a data base for monitoring and/or contingency planning purposes;

- the provision of data necessary to respond to agency and public concerns and priorities.

The suggested mitigative/compensation measures represent a broad range of possible measures which might help prevent, reduce or offset potential risks and impacts. It may well be determined that some measures:

- are unnecessary;
- can be substituted for other measures;
- are undesirable, i.e. more adverse effects might result from the measure than from the risk or impact that they are directed towards;
- require action by or cooperation by agencies or parties other than OWMC.

Finally, OWMC's decisions regarding both additional analyses and mitigative/compensation measures will be the product of extensive internal deliberations, as well as extensive discussions with interested and affected agencies, groups and individuals.

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of Phase 4A of the Ontario Waste Management Corporation (OWMC) site selection process is to select a preferred site(s)* for a special waste* treatment and disposal facility[1]. This report, Site Selection Process, Phase 4A: Selection of a Preferred Site(s) - Site Selection, prepared by M.M. Dillon Limited, provides the technical documentation of the role assumed by a team of site selection consultants in the comparison of eight candidate sites (see Figure 1.1). It also addresses the major reasons for the Phase 4A conclusions reached by the site selection team and by the site selection coordinating consultant, M.M. Dillon Limited.

1.2 BACKGROUND

The Ontario Waste Management Corporation (OWMC) has implemented a five-step approach for the selection of an environmentally safe location or locations for the establishment of its special waste treatment and disposal facilities. (See Figure 1.2.) These steps are as follows:

Step 1: Narrow the search to a geographic region in Ontario.

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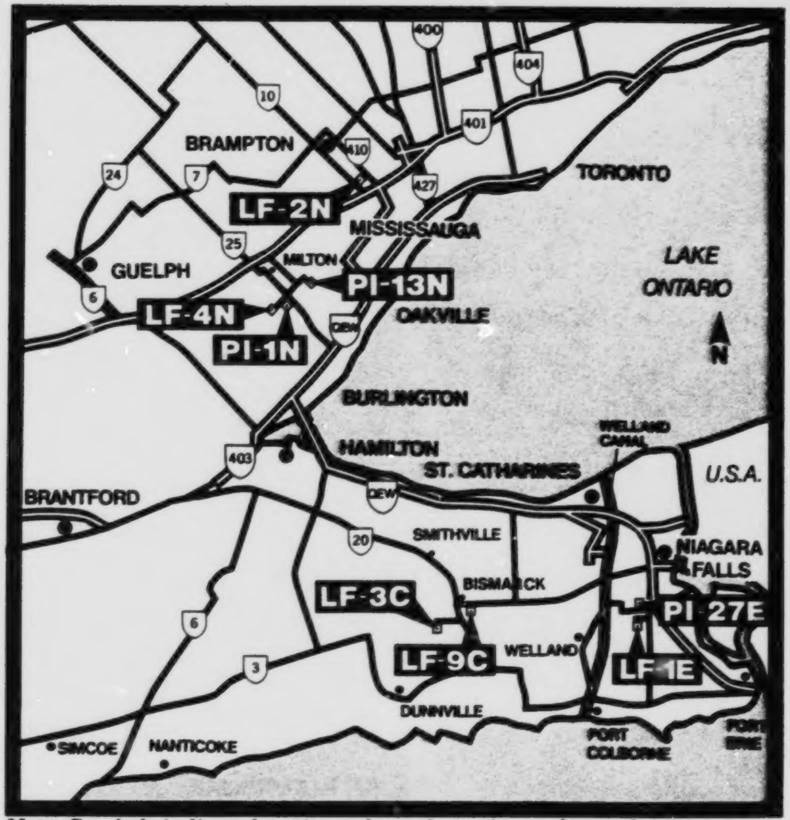
[1] This report uses a great many terms of a technical nature or in a particular manner. A glossary of these terms is provided at the back of the volume. The first time that each of these terms appears in the volume, it is marked by an asterisk.

FIGURE 1.1

CANDIDATE SITES - SITE LOCATION


400
404
10
401
BRAMPTON
410
TORONTO
24
7
427
LF-2N
MISSISSAUGA
25
MILTON
LAKE
ONTARIO
GUELPH
PI-13N
6
LF-4N
OAKVILLE
QEW
N
PI-1N
BURLINGTON
WELLAND CANAL
HAMILTON
403
ST. CATHARINES
U.S.A.
BRANTFORD
QEW
20
SMITHVILLE
NIAGARA FALLS
BISMARCK
LF-3C
PI-27E
6
WELLAND
LF-9C
LF-1E
3
DUNNVILLE
PORT COLBORNE
FORT ERIE
SIMCOE
NANTICOKE

Note: Symbols indicate location only, and not size or shape of sites.

Site Name	Landfill	Physical/ Chemical	Incinerator	
LF-2N	•	•		
LF-4N	•	•		
LF-3C	•	•	•	Integrated
LF-9C	•	•	•	Integrated
LF-1E	•	•	•	Integrated
PI-1N		•	•	
PI-13N		•	•	
PI-27E		•	•	

OWMC, 1985.

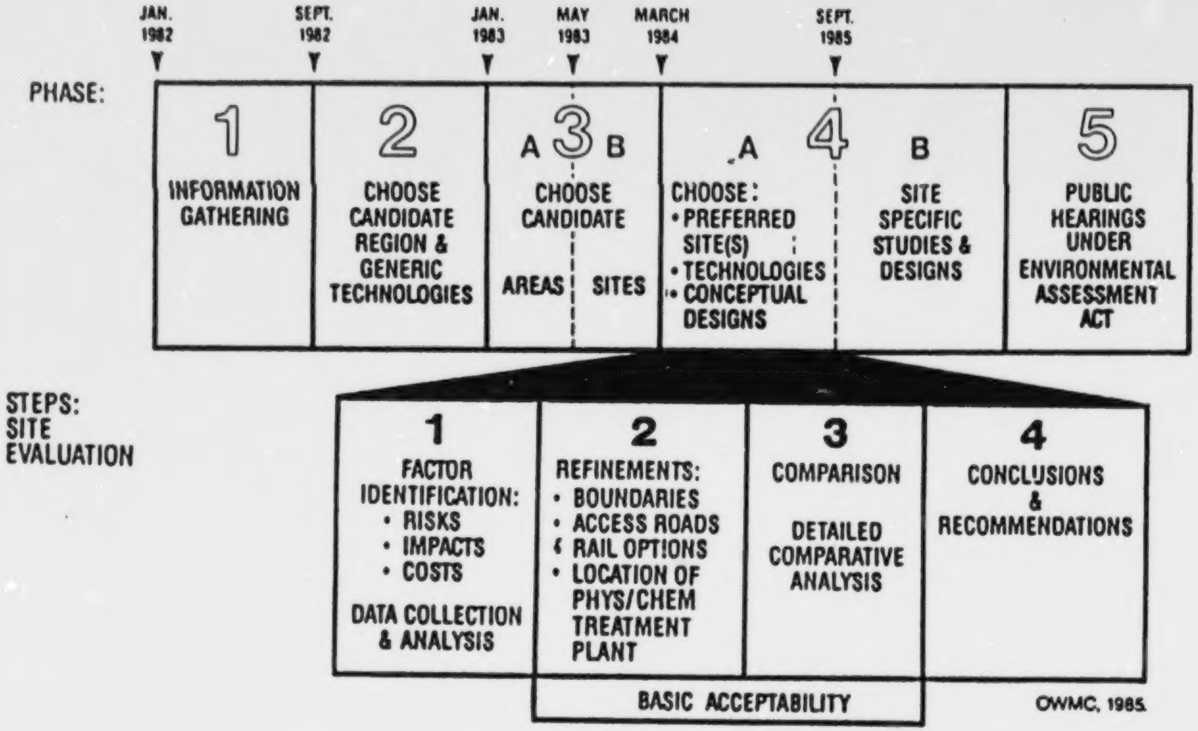
LEGEND

▫ Candidate Sites
═ 400 Series Highways
— Other Highways & Roads

0 10
Kilometres
0 10
Miles

FIGURE 1.2

FACILITIES DEVELOPMENT PROCESS


PHASE:
JAN. 1982
SEPT. 1982
JAN. 1983
MAY 1983
MARCH 1984
SEPT. 1985
1
INFORMATION GATHERING
2
CHOOSE CANDIDATE REGION & GENERIC TECHNOLOGIES
A 3 B
CHOOSE CANDIDATE
AREAS
SITES
A 4 B
CHOOSE:
• PREFERRED SITE(S)
• TECHNOLOGIES
• CONCEPTUAL DESIGNS
SITE SPECIFIC STUDIES & DESIGNS
5
PUBLIC HEARINGS UNDER ENVIRONMENTAL ASSESSMENT ACT
STEPS: SITE EVALUATION
1
FACTOR IDENTIFICATION:
• RISKS
• IMPACTS
• COSTS
DATA COLLECTION & ANALYSIS
2
REFINEMENTS:
• BOUNDARIES
• ACCESS ROADS
• RAIL OPTIONS
• LOCATION OF PHYS/CHEM TREATMENT PLANT
3
COMPARISON
DETAILED COMPARATIVE ANALYSIS
4
CONCLUSIONS & RECOMMENDATIONS
BASIC ACCEPTABILITY

OWMC, 1985.

Step 2: Identify candidate areas suitable for each facility component within this geographic region.

Step 3: Identify candidate sites within candidate areas.

Step 4: Evaluate candidate sites and select preferred site(s).

Step 5: Test and assess preferred site(s) in detail.

Step 1 is documented in the OWMC Phase 1 (1982) and Phase 2 (1983a) Reports. Step 2 (Phase 3A), the selection of 19 candidate areas within the geographic region is documented in the OWMC Interim Phase 3 Report (1983b) and Step 3 (Phase 3B) is documented in the OWMC Phase 3 Report (1984a and b).

Step 3 is documented in greater detail in a four-volume technical report prepared by M.M. Dillon Limited (Dillon), entitled Site Selection Process - Phase 3B: Selection of Candidate Sites - Site Selection (1984b). Volume 1 documents the process by which site areas were identified within the candidate areas. Volume 2 documents the procedures employed to identify potential sites within the site areas and Volume 3 documents the process by which the potential sites were compared to produce a short list of candidate sites. The fourth volume, a map portfolio, contains the major maps which support Volumes 1, 2 and 3.

This report addresses the first part of the fourth step (Phase 4A) the detailed comparative evaluation of the eight candidate sites. In the next stage (Phase 4B), further design, together with detailed site-specific studies, will be undertaken for the preferred site. The Facilities Development process will culminate in a submission to the Ministry of the Environment under the Environmental Assessment Act.

1.3 SCOPE AND LIMITATIONS

Figure 1.2 illustrates the four major steps of the Phase 4A site selection process. In brief, these steps consist of:

- the identification of factors* used to refine and compare the siting options[1]; factors define the scope of the Phase 4A data collection and analyses;

- the refinement of siting options*. This step involved the refinement of site boundaries (for three sites), the comparison of access roads* to and between siting options, the comparison of rail access options for the potential haulage of additives and reagents* (as a potential means of reducing access road impacts) and the comparison (for the partially integrated siting options) of whether to place the physical/chemical treatment plant with the incineration plant or the engineered landfill;

- an assessment of whether any of the candidate sites was unsuitable (basic acceptability analysis*) based on new data obtained during Phase 4A;

- the detailed comparative evaluation of the six siting options - LF-9C, LF-3C, LF-4N/PI-1N, LF-4N/PI-13N, LF-1E/PI-27E and LF-1E[2]. The detailed comparative evaluation of siting options involves four different evaluation procedures - the differences and tradeoffs synthesis (Chapter 5, Volume 2), the synthesis of disciplinary perspectives (Chapter 6, Volume 2) and two quantitative aggregation* procedures (Chapter 7, Volume 2). A number of analyses were also undertaken to test the sensitivity of results to alternative assumptions and interpretations.

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[1] Siting option refers to the combination of sites required to accommodate all OWMC facilities. An integrated siting option involves all three facilities located on one site. For a partially integrated option, two sites are required to accommodate the facilities, i.e. landfill (one site), incinerator (alternate site) and physical/chemical treatment plant (paired with either the engineered landfill or incineration plant).

[2] As described in Chapter 8 of Volume 1, LF-2N in Mississauga was dropped as a result of the basic acceptability analysis.

- the formulation of conclusions and recommendations arising out of the analysis.

This report represents the synthesis of the inputs of a range of specialist consultants. Any limitations or qualifications identified in the other Phase 4A site selection and engineering reports also apply to this report.

The Phase 4A Facilities Development Process involved a division of responsibility. Certain activities, notably waste characteristics and quantities, technology assessment, public consultation*, and corporate policy were undertaken or coordinated directly by OWMC. An effort has been made to ensure that these activities and the site selection process are fully integrated and mutually supportive. Reference should be made to OWMC and its reports regarding these matters. The engineering analysis was coordinated directly by OWMC, although as indicated in Sections 2.7 and 2.8 of this volume, the environmental and engineering components of the site selection process were closely coordinated.

The focus of the Phase 4A site selection process is the comparative evaluation of the eight candidate sites. Risks* and impacts* that did not vary greatly among options are not addressed in as much detail as those concerns which represented major differences among options. Similarly, the potential for mitigation* and compensation is only addressed to the extent that such measures might either influence the basic acceptability of a site or the ranking of the siting options*. Mitigation and compensation potential has been addressed in both the detailed comparative evaluation of siting options and in a series of sensitivity analyses*. It has also been addressed in recommendations for future analyses.

Through the course of Phase 4A there were inevitably differences regarding the level of confidence which could be attached to particular components of the analysis. These differences stemmed from the limited number of facilities of this type which have been constructed and monitored, the evolving state of the technology and the difficulty in making long-term predictions of complex, interrelated risks and impacts. The general approach taken to address these areas of uncertainty is a high standard of facility design and operations (see Monenco, 1985 and 1986) and the use of conservative assumptions* such that predicted risks and impacts tend to be overestimated.

1.4 RELATIONSHIP TO OTHER REPORTS

The OWMC Phase 4A Report (OWMC, 1985d) describes the Phase 4A Facilities Development Process including an overview of the Phase 4A site selection process. This report provides a more detailed documentation of all Phase 4A site selection activities. It represents the integration of the work undertaken by all the participants in the site selection process.

This report synthesizes the Phase 4A site selection activities carried out by a team of consultants specializing in geologic, hydrogeologic, geotechnical, surface water, biological, land use, social, economic, air quality and dispersion, agricultural, transportation, risk assessment and engineering concerns. Each consulting firm prepared a separate technical report (see List of References), documenting its specific contributions to the site selection process. In addition, a number of specialist subconsultants, in such fields as tourism, visual impact and noise, provided inputs to the site selection process. Reference should be made to the reports of each consultant for a more detailed description of their respective roles.

1.5 REPORT FORMAT

This report is comprised of two volumes together with a separately bound set of Appendices to Volume 2. The first volume (this volume) consists of the following chapters:

- Chapter 1 (this chapter) is the introduction;
- Chapter 2 provides an overview of the Phase 4A approach, including a description of such matters as goals*, objectives*, factors* and indicators*, roles and responsibilities, the site selection process, study areas*, time horizons and facilities characteristics assumptions*;
- Chapter 3 provides a brief overview of the process and methods employed in the four components of the refinement of siting options;
- Chapter 4 presents the refinement of site boundaries for sites LF-3C, LF-1E and PI-1N;
- Chapter 5 details the staged comparison of access road options and presents conclusions regarding preferred access routes;
- Chapter 6 documents the identification and comparative analysis of rail access options and presents conclusions regarding preferred rail access;

- Chapter 6 documents the identification and comparative analysis of rail access options and presents conclusions regarding preferred rail access;
- Chapter 7 documents the analysis for the location of the physical/chemical treatment plant for partially integrated siting options (i.e. placement of the physical/chemical treatment plant with the engineered landfill or with the incineration plant);
- Chapter 8 presents the basic acceptability analysis.

The appendices pertinent to each chapter of Volume 1 are bound under separate cover.

Volume 2 addresses the detailed comparative evaluation of siting options. Major components of Volume 2 include approach, existing environment, design modifications, the identification and ranking of factors and the comparative evaluation of siting options, including four evaluation procedures and a series of sensitivity analyses, and the accompanying technical appendices.

2.0 APPROACH TO EVALUATION

2.1 INTRODUCTION

This chapter provides an overview of the major elements of the approach employed to evaluate the candidate siting options. It includes a description of how the site selection goals and objectives, factors, indicators and principles were employed in Phase 4A. It also provides an overview of the Phase 4A site selection process. The roles and responsibilities of the major participants in the site selection are noted. An overview of the Phase 4A study areas and time horizons is presented. Finally the Phase 4A facilities characteristics assumptions and their role in site selection are highlighted.

2.2 GOALS, OBJECTIVES, FACTORS AND INDICATORS

Goals and objectives represent the ends towards which the site selection process is directed. Goals address broad areas of consideration in site selection. Objectives are somewhat more specific. They represent a refinement and elaboration of goals. In the case of the goal of minimizing environmental impacts, for example, the objectives specify different elements of the environment to be protected. The goals and objectives apply to the entire site selection process. Factors are the detailed criteria used to compare options in different stages of the site selection process. The interrelationships among goals, objectives, factors and indicators are illustrated in Figure 2.1.

An overview of the goals and objectives employed in the comparative evaluation of the siting options is provided in the following subsections.

2.2.1 GOALS

Three site selection goals have been developed and adopted by OWMC to guide the process of identifying and evaluating candidate sites. These three site selection goals, ranked by OWMC in the following order of importance (from most to least important), are:

1) to minimize risk to human health;

2) to minimize environmental impact;

3) to minimize financial costs to OWMC and the people of Ontario.

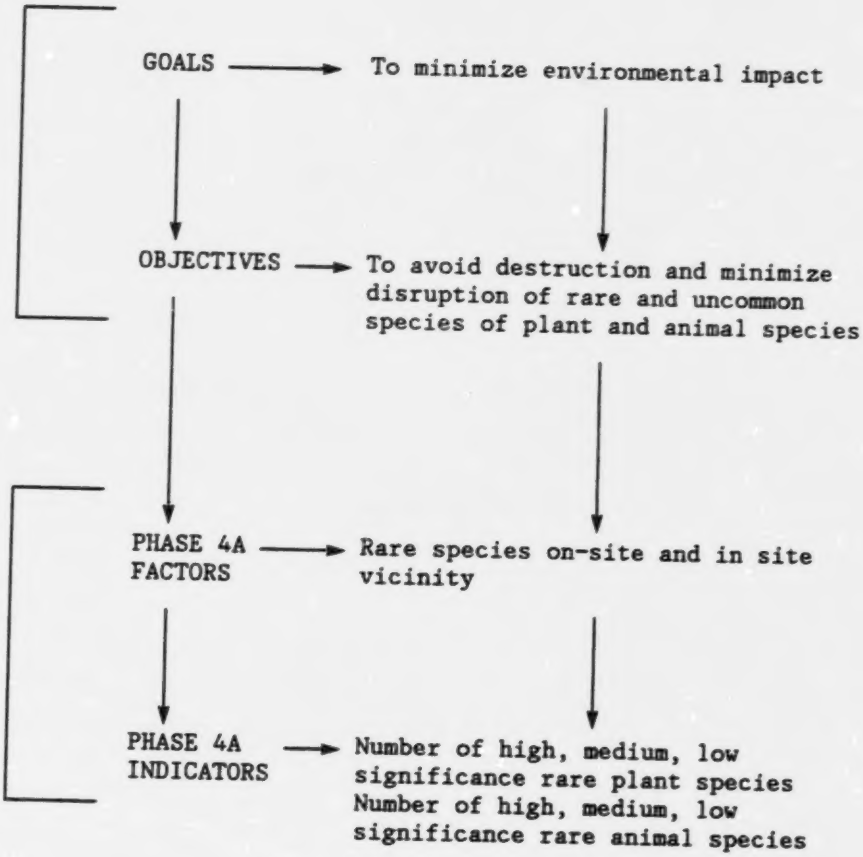
Although this ranking reflects the general priorities of OWMC, there could be instances where relatively minor risk-related concerns would be superseded by major environmental impacts. Similarly, a major cost consideration might supersede a minor risk or environmental impact consideration.

An elaboration of each of these site selection goals is provided in the following subsections.

(a) To select a site(s) which minimizes risk to human health.

FIGURE 2.1

Interrelationships Between Goals, Objectives
Factors and Indicators
Example - Rare Species


GOALS
OBJECTIVES
PHASE 4A FACTORS
PHASE 4A INDICATORS

GOALS → To minimize environmental impact

OBJECTIVES → To avoid destruction and minimize disruption of rare and uncommon species of plant and animal species

PHASE 4A FACTORS → Rare species on-site and in site vicinity

PHASE 4A INDICATORS → Number of high, medium, low significance rare plant species
Number of high, medium, low significance rare animal species

For purposes of this report risk is defined as the "probability of injury, disease or death as a result of exposure* to toxic substances" (Environ, 1985).

The site selection process in Phase 4A contributed to the minimization of risk through the use of four factor groupings for which the potential for exposure to toxic waste would vary depending on which site or sites were selected for the establishment of the facility. The four risk factor groupings include:

> Transportation - the likelihood of exposure or injury created by truck accidents or spills along the access route.
>
> Air - the likelihood of exposure to contaminants released from the stack or fugitive emissions.
>
> Surface Water - the likelihood of exposure through the release of contaminants from the site into a river or local watercourse.
>
> Ground Water - the likelihood of exposure to contaminants that have migrated from the site into the groundwater to which an individual is exposed.

An important contribution to the consideration of risk in Phase 4A was a generic risk assessment* study undertaken by Environ Corporation. The purpose of the study was, "to provide OWMC with a better understanding of the relative importance of siting factors related to human health risk*" (Environ, 1985). The generic risk assessment was designed to provide quantitative estimates of public health risks associated with the emission of toxic pollutants from the proposed hazardous waste treatment and disposal facility. The term "generic" indicates that the risk assessment used a single set of generalized site parameters applicable to all sites rather than characteristics specific to each candidate site. This was considered appropriate at the level of detail used in the comparative evaluation of siting options (Environ, 1985).

(b) To select a site(s) which minimizes environmental impact.

The environment encompassed by this goal is extremely broad. It includes biological, physical and other natural resources, archaeological, land use, land ownership, and social, economic and municipal financial concerns and considerations.

The site selection process minimizes the potential for and severity of adverse environmental impacts with the emphasis on identifying the most significant or sensitive potential impacts as well as the impacts most difficult to avoid or reduce.

The impact factors are grouped in three ways, each reflecting a somewhat different perspective.

1) On a component or feature* of the environment basis i.e. residents, businesses, community facilities and services, land use, agricultural, natural environment and community and region.

2) On a disciplinary basis i.e. social, economic, land use, agriculture, air dispersion, municipal finance, biology and archaeology. The disciplinary approach enabled the consultants responsible for each discipline, e.g. social, to draw together all the issues and concerns embraced by their discipline as a basis for a reasoned professional judgement. In some instances this meant integrating the reports of specialist subconsultants. The social consultant, (the Institute of Environmental Research Inc.) for example, incorporated the inputs of two tourism consultants, a visual consultant and an historical consultant.

3) On a study area basis i.e. site, site vicinity*, access roads, air dispersion zones*, community and regional*. The study area distinctions facilitated the consideration of the cumulative effects on people and communities in different geographic areas.

(c) To minimize financial costs to OWMC and the people of Ontario.

As a public agency responsible for the expenditure of public funds, it is OWMC's responsibility to derive the maximum benefit from expenditures. It is the responsibility of OWMC to expend funds in the most efficient and effective manner possible.

With regard to the site selection process, this goal encompasses the consideration of relative cost differences in such potential areas of expenditure as: transportation costs, site acquisition, on-site development costs, off-site development costs and facility operations costs.

The consideration of financial costs in site selection does not necessarily mean that financial considerations were ranked higher than risk and impact-related considerations. Although minimizing cost was ranked as the lowest priority goal, there could be instances where a minimal reduction in risk or impact would have substantial financial implications for OWMC. In addition, engineering flexibility was introduced into the sensitivity analyses to determine if the design development of the facility would be significantly constrained by the selection of any siting option.

2.2.2 OBJECTIVES

A large number of objectives were developed by the site selection team to assist in shaping and directing the site selection process. These objectives are presented in the Appendix to the OWMC Phase 3 Report (1984b).

The site selection objectives were developed and derived from a variety of sources including consultant, public and agency comments and concerns and experiences with comparable projects.

By the end of Phase 4B, all the site selection objectives will be addressed. However, because of differences in the characteristics and roles of various steps in the site selection process, e.g. variations in scales and levels of detail, different objectives have been addressed at different stages in the site selection process as well as to varying extents and levels of detail.

2.2.3 FACTORS AND INDICATORS

Factors represent a positive or negative[1] risks, impacts or cost consideration which would assist in comparing various sets of options.

(a) Organization of Phase 4A Factors

The factors have been structured into four levels.

- study goals;
- factor groupings*;
- factors; and
- indicators

Distinctions have also been drawn in terms of the study areas which pertain to each factor.

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[1] An example of a negative impact is the displacement of rare species on-site. An example of a positive impact is municipal finance benefits.

(i) Study Goals: The three goals are: risks, impacts and engineering cost.

(ii) Factor Groupings: The 15 factor groupings reflect the major areas of concern addressed in Phase 4A within each of the goals. They include:

- risk to human health
  - transportation risks
  - air quality risks
  - risks related to hydrogeologic suitability
  - risks related to surface water suitability

- environmental impacts
  - impacts on residents
  - impacts on businesses
  - impacts on community and recreation features
  - community and regional impacts
  - land use impacts
  - impacts on agricultural resources
  - natural environmental impacts
  - air dispersion/air quality impacts

- engineering
  - site area
  - cost
  - flexibility

iii) Factors: Factor groupings are subdivided into factors. Factors represent the major elements or dimensions within the factor groupings. Most of the comparative evaluation of options took place at this level. An example of a factor within the transportation risk factor grouping is transportation risks on local and regional access roads due to hazard-based spills from OWMC generated transport.

Indicators: Factors are subdivided into indicators. Indicators are ways of identifying, describing and predicting risks, impacts and costs. Examples of indicators for the factor existing land use are existing land use patterns, number of residences and industrial and commercial facilities. In some cases, consultants identified sub-indicators to further describe risks, impacts and costs. These sub-indicators are listed only in consultants' individual reports.

(b) Identification and Refinement of Factors and Indicators

The reports of the individual site selection consultants detail the process by which indicators were identified, modified and combined. An overall list of Phase 4A factors and indicators were formulated by the site selection team. This overall list was subject to OWMC, agency and public review. Public comments were received through a series of OWMC factor identification workshops as well as a review of public submissions.

The reports of the individual site selection consultants detail the process by which indicators were identified and modified. Consultants' reports also detail the process of identifying and modifying factors within each consultant's area of expertise. This report addresses the process for applying the factors for decision-making purposes.

Different factors and indicators were drawn from the Phase 4A factor and indicator list and employed at different stages of the Phase 4A site selection process. In some instances, this meant modifications to the factors and indicators to facilitate the consideration of the options under review. As illustrated in Table A.1 in Appendix A, different factors were employed for each of the four steps in the

Refinement of Siting Options and in the Comparison of Siting Options. As illustrated in the first column in Table A.1, the impact factors have also been differentiated on a study area basis.

(c) Factor and Indicator Ranking*

A method was required to indicate the relative importance of the factors. Consequently, the factors were ranked by the individual consultants and a composite ranking of all factors was prepared by M.M. Dillon Site Selection. Variations in ranking occurred based on the level of analysis. For example, slight changes in ranking levels occurred for refinement of siting options and siting option comparisons. The rationale for these changes are explained as they occur in this report.

2.3 SITE SELECTION PRINCIPLES

A series of principles, intrinsic to the process of identifying candidate sites, was identified in the OWMC Phase 3 Interim Report (1983b). These principles are highlighted in Table 2.3. These principles also apply to the process of refining and comparing the eight candidate sites. The role which these site selection principles assumed in Phase 4A is highlighted in Table 2.1.

2.4 SITE SELECTION PROCESS

The process of selecting a preferred siting option involved five major steps as indicated in Figure 2.1. Public input was incorporated into each of the first three steps and into step 5.

TABLE 2.1

Role of Site Selection Principles in Phase 4A

SITE SELECTION PRINCIPLES IDENTIFIED IN THE OWMC INTERIM PHASE 3 REPORT	ROLE IN PHASE 4A SITE SELECTION
Progressive Refinement of the Search Process The process must evolve in a series of steps which involve the evaluation of alternatives and the narrowing of geographic focus.	° refinement of siting options in a staged manner ° reduction of comparison of siting options to a relatively small number of major impacts and tradeoffs ° process narrowed eight candidate sites to one preferred siting option
Definition of the Environment The very broad and inclusive definition of the environment used in the Ontario Environment Assessment Act (1975) has been adopted by OWMC.[1]	° wide range of considerations encompassed by site selection goals, objectives and factors
Protection of Human Health and the Environment The primary considerations must be protecting human health and the environment	° factors related to protection of human health and the environment rank higher than factors pertaining to cost

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[1] As of July, 1985 the OWMC undertaking is subject to the requirements of Ontario's Environmental Assessment Act.

TABLE 2.1

Role of Site Selection Principles in Phase 4A

SITE SELECTION PRINCIPLES IDENTIFIED IN THE OWMC INTERIM PHASE 3 REPORT	ROLE IN PHASE 4A SITE SELECTION
The Involvement of Those Affected Affected agencies, organizations and people must be consulted at key decision points in the process. OWMC is committed to a thorough consultation program.	° general concerns raised through OWMC public meetings, workshops and information centres, the "Walk and Talk" program, meetings with citizens' groups, meetings with land owners and submissions incorporated into site selection process ° public and agency inputs to the identification, ranking and application of factors and indicators obtained through a series of OWMC workshops ° public inputs to the identification of major impacts and tradeoffs
Efficiency and Effectiveness of the Process The cost and time involved in conducting a detailed analysis and evaluation of every conceivable site across the province are prohibitive. Resources must be used to effectively and efficiently conduct a systematic search and selection process which focuses available resources on critical concerns and provides definite conclusions in a timely manner.	° focused analysis on major issues and differences among siting options ° focused analysis on issues of particular agency and public concerns
A Second Natural Level of Protection of the Environment A second level of protection of the environment beyond that provided	° policy of OWMC - design and operations of the facility provides

TABLE 2.1

Role of Site Selection Principles in Phase 4A

SITE SELECTION PRINCIPLES IDENTIFIED IN THE OWMC INTERIM PHASE 3 REPORT	ROLE IN PHASE 4A SITE SELECTION
for by the design and operating procedures of the facility component is essential.	a first level of protection for the environment through such measures as encouraging the minimization of the wastes generated, use of best proven technology, facility component design, construction procedures, encouraging appropriate control procedures, operational procedures and occupational health and safety procedures ° no combination of engineering measures can, however, completely eliminate potential for human health effects; remote possibility of release and some uncertainty regarding long term health effects ° site selection approach therefore contributed to second level of protection by: - considering potential for an accidental release on site or in transit - considering the potential for the detection, containment and clean-up of special wastes in the event of accidental release, e.g. favouring soils with characteristics which provide natural containment - considering potential for exposure of people to contaminants and/or avoiding pathways for contaminants to people

TABLE 2.1

ROLE OF SITE SELECTION PRINCIPLES IN PHASE 4A

SITE SELECTION PRINCIPLES IDENTIFIED IN THE OWMC INTERIM PHASE 3 REPORT	ROLE IN PHASE 4A SITE SELECTION
Likelihood of Suitability The suitability of the preferred siting option can be expressed at this stage only as a relative likelihood of suitability subject to Phase 4B, more detailed investigation.	° consideration given to areas of uncertainty associated with each siting option ° general preference to sites which have the greatest suitability when more detailed confirmation analyses undertaken
Maintenance of Choice As decisions or exclusions are made, there must be the awareness at each stage of the process that no significant or unique alternatives are being discarded.	° consideration of engineering choices retained or lost was a consideration in the comparison of options ° no sites or areas absolutely eliminated; such final decisions will only be made once the site selection process is complete and OWMC is satisfied that a safe site had been identified

2.4.1 STEP 1 - DATA COLLECTION AND FACTOR IDENTIFICATION

(a) Data Collection and Analysis

The evaluation process began by compiling the Phase 4A data obtained by the individual site selection consultants from such sources as field investigations and on-site testing, interviews with area residents, businesses and municipalities, a "drop-off" survey of residents, reviews of secondary source data (e.g. accident statistics, water well records), and meetings with provincial ministries and agencies. These data were complied into a series of detailed data matrices*. In the case of site and site vicinity study areas, the results of the Phase 4A field surveys and testing were compiled into a series of data maps.

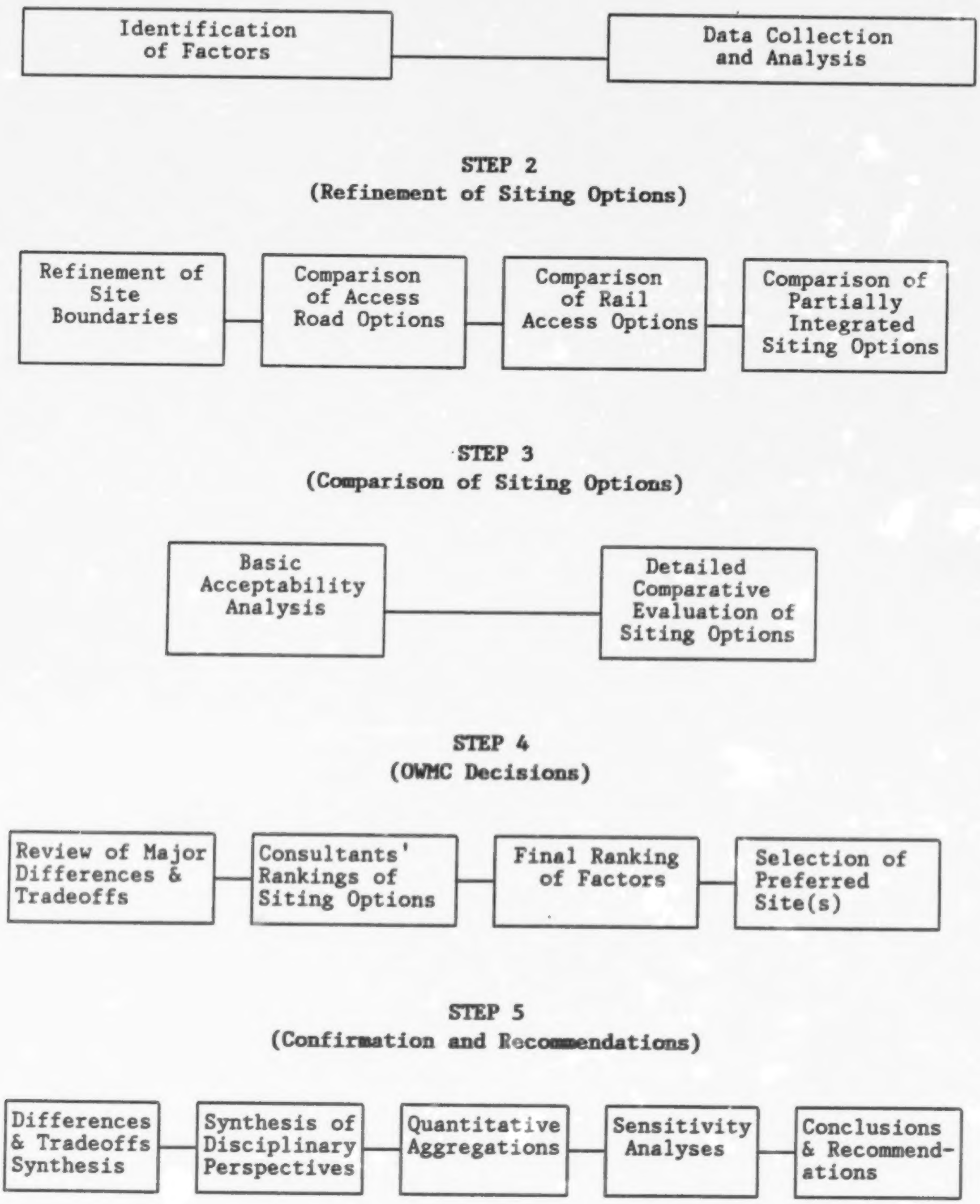
Further details on the Phase 4A data collection and analysis are found in the reports of the individual site selection consultants. An overview of the existing environment potentially affected by each set of options is provided in Chapters 4 through 7 in Volume 1 and in Chapter 2 in Volume 2.

(b) Factor Identification

The site selection team established the Phase 4A factors to be used in evaluating the differences and similarities in potential risks, impacts and costs associated with the establishment of a special waste management facility.

The factors employed for each set of options are identified in Chapters 4 through 7 in Volume 1 and Chapter 4 in Volume 2. More detailed

Figure 2.2
PHASE 4A - SITE EVALUATION PROCESS


STEP 1
(Data Collection and Factor Identification)
Identification of Factors
Data Collection and Analysis
STEP 2
(Refinement of Siting Options)
Refinement of Site Boundaries
Comparison of Access Road Options
Comparison of Rail Access Options
Comparison of Partially Integrated Siting Options
STEP 3
(Comparison of Siting Options)
Basic Acceptability Analysis
Detailed Comparative Evaluation of Siting Options
STEP 4
(OWMC Decisions)
Review of Major Differences & Tradeoffs
Consultants' Rankings of Siting Options
Final Ranking of Factors
Selection of Preferred Site(s)
STEP 5
(Confirmation and Recommendations)
Differences & Tradeoffs Synthesis
Synthesis of Disciplinary Perspectives
Quantitative Aggregations
Sensitivity Analyses
Conclusions & Recommendations

descriptions of individual factors and of indicators and subindicators* which contributed to the factors are provided in the individual consultants' reports.

2.4.2 Step 2 - Refinement of Siting Options

Before it was possible to compare siting options it was first necessary to refine the siting options by making decisions on site boundaries, access roads, rail access and the placement of the physical/chemical treatment plant with either the incineration plant or the engineered landfill.

(a) Refinement of Site Boundaries

In Phase 4A revised site boundaries were identified for candidate sites LF-3C, PI-1N and LF-1E. Major site and site vicinity features* were delineated in a constraint mapping* procedure. The major risk, impact and engineering constraints* were reviewed and evaluated by the site selection team to identify the revised boundaries for each of the three sites.

A more detailed account of the refinement of site boundaries process and results is found in Chapter 4 of Volume 1.

(b) Access Road Options

The comparative evaluation of the alternative local and regional access roads for each siting options occurred in two steps:

(i) an initial or preliminary analysis of access roads;

(ii) a more detailed comparative evaluation of the short list of local and regional access road options.

The evaluation process during the initial or preliminary analysis involved the identification and ranking of factors and the compilation of existing data into a series of matrices which highlighted the major differences among the access road options for each site. An overall ranking of access road options was derived and a number of options were dropped from further consideration.

The second step resulted in the selection of preferred access routes for each siting option. This analysis was based on a much broader range of factors and consequently a more detailed data base. Additional information was collected by the individual site selection consultants through interviews with residents and operators of community facilities, meetings with provincial ministries and agencies, reviews of secondary source materials and roadside field investigations extending 800 metres on either side of the local and regional access roads. The data were compiled in matrices and working maps.

The factors and indicators were ranked on the basis of their relative importance to minimizing access road risks and impacts. An overall ranking of access road options was derived from a review of the major differences among the options.

Further details on the Phase 4A analysis of access road options and the results of the analysis are found in Chapter 5 of Volume 1.

(c) Rail Access Options

The analysis of rail access options to each site assumes that rail service is not an absolute requirement for facility operations. OWMC determined that rail services would be treated as an opportunity to be realized only if those services offered significant advantages, for example, reduced truck volumes, and that these advantages would not be offset by the major impacts and costs associated with rail service. It was also assumed that the only economical use of rail service in the foreseeable future would involve the transportation of additives and reagents such as cement for the solidification process.

The analysis of rail access options was conducted in two steps:

(i) the preparation of composite constraint maps to identify rail access options from existing rail lines to the sites;

(ii) a more detailed comparative evaluation of rail access options to each site.

Both steps pertained to the area between the site and the nearest main rail line.

The rail access options analysis began with the identification of a series of transportation, biological, surface water, socio-economic, land use, agricultural and engineering factors. The rail access factors were then ranked in order of importance. The options were compared using summary matrices and composite constraint maps. These matrices and maps served as a basis for identifying and comparing the major tradeoffs associated with the options. The conclusions were based on the consideration of major differences among options and the relative importance of the factors.

Further details on the analysis of rail access options and the results of the analysis are found in Chapter 6 of Volume 1.

(d) Location of Physical/Chemical Treatment Plant for Partially Integrated Options

Among the eight candidate sites there were 13 facility location possibilities. These possibilities involve either a fully integrated facility option or a partially integrated facility option.

A fully integrated facility option involves an engineered landfill, a physical/chemical treatment plant and an incineration plant all located on one site. A partially integrated facility option has two sites and involves a choice of locating the physical/chemical treatment plant with the engineered landfill site or with the incineration plant.

The choice of locating the physical/chemical treatment plant with the engineered landfill or incineration plant involved such considerations as cost and landfill life, transportation risks and impacts, site vicinity risks (as a result of fugitive emissions from the physical/chemical treatment plant), and impacts such as noise and land use compatibility.

The factors were ranked in order of importance. A preference was established based on a review of the major differences between the options taking into consideration the factor rankings. A quantitative cross-check of results was then undertaken.

Further details on the location of the physical/chemical treatment plant analysis and results are found in Chapter 7 in Volume 1.

2.4.3 Step 3 - Comparison of Siting Options

The comparison of siting options is divided into two streams of activity - basic acceptability analysis and detailed comparative evaluation.

(a) Basic Acceptability Analysis

The basic acceptability analysis addressed severe new constraints identified as a result of the Phase 4A data collection. A constraint was considered severe if it would result in the rejection of a site, regardless of the suitability of the site in terms of other factors. The site selection team's assessment of basic acceptability focused on:

- the identification of clear thresholds of acceptability;
- the extent to which potential risks or impacts could be offset through design or operational modifications;
- the level of confidence which can be placed on the data interpretation.

Where there was doubt regarding the basis for rejecting a site, the site was retained for further consideration. In this way, no potentially suitable site was rejected prematurely.

As a result of the basic acceptability analysis, site LF-2N in Mississauga was rejected in May, 1985. LF-2N failed to provide natural containment. The bases for rejecting LF-2N are described in the M.M. Dillon report entitled Interim Site Selection Report - Candidate Site LF-2N (M.M. Dillon, 1985a).

It was subsequently determined that PI-13N also failed to provide natural containment. As this determination was only confirmed when the detailed comparative evaluation process was largely completed, PI-13N was included in the detailed comparative evaluation. Further details on the basic acceptability analyses are found in Chapter 8 in Volume 1.

(b) Detailed Comparative Evaluation of Siting Options

The detailed comparative evaluation of siting options was largely based on the consideration of major differences and tradeoffs* between pairs of siting options taking into account the ranking of factors. The following siting options were examined in the detailed comparative evaluation: LF-4N/PI-1N, LF-4N/PI-13N, LF-3C, LF-9C, LF-1E and LF-1E/PI-27E.[1]

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[1] Siting options LF-2N/PI-1N and LF-2N/PI-13N were not included in this analysis since LF-2N had been previously eliminated in the basic acceptability analysis.

The summary analysis and conclusions of the individual consultants, together with the background data contained in the matrices and working maps, were employed to evaluate and compare the siting options. Concerns and preferences obtained through the OWMC public consultation program also contributed to the ranking of factors and to the identification and refinement of differences and tradeoffs. This analysis enabled the site selection team to more precisely identify and explore the major risks and impacts associated with each siting option and the tradeoffs between siting options.

In reviewing the characteristics of the siting options it became apparent that the differences among siting options within the same geographic cluster* appeared less pronounced than the differences among siting options not within the same geographic cluster. It was therefore, decided first to compare siting options within geographic clusters using a paired comparison approach, i.e. Milton (LF-4N/PI-1N vs. LF-1N/PI-13N), West Lincoln (LF-3C vs. LF-9C) and Niagara Falls (LF-1E vs. LF-1E/PI-27E). A comparison of the preferred options from each cluster was then undertaken. This analysis resulted in a narrowing of the options to a choice between one of the West Lincoln options (LF-9C) and one of the Niagara Falls options (LF-1E/PI-27E).

The paired comparison of differences and tradeoffs was undertaken on a study area basis. Individual site selection consultants also derived overall disciplinary rankings of the siting options.

2.4.4 STEP 4 - OWMC DECISIONS

The OWMC decisions were based on a review of the study area differences and tradeoffs analysis and on a review of the disciplinary siting option rankings. OWMC also considered comments received through the OWMC public consultation program regarding differences and tradeoffs and the ranking of factors.

The rationale for the OWMC selection of LF-9C in West Lincoln is contained in the *OWMC Phase 4A Report, Facilities Development Process*, (OWMC, 1985d).

2.4.5 STEP 5 - CONFIRMATION AND RECOMMENDATIONS

Subsequent to the selection by OWMC of LF-9C, the evaluation was refined and documented. Four evaluation procedures were employed. Each procedure served as a cross-check to the other procedures. The four procedures are: the identification of major differences and tradeoffs using a paired comparison process (Chapter 5, Volume 2), the synthesis of disciplinary perspectives (Chapter 6, Volume 2), and two quantitative aggregation procedures (Chapter 7, Volume 2). A further cross-check against all four procedures was a series of quantitative and qualitative sensitivity analyses which assessed if the conclusions would change under alternate assumptions and interpretations (Chapter 8, Volume 2).

The results of the four evaluation procedures, and the sensitivity analyses, were then reviewed and compared in deriving overall conclusions and recommendations. These conclusions and recommendations addressed both the results of the Phase 4A analyses and areas where further analysis was considered desirable. These conclusions and recommendations are detailed in Chapter 9 of Volume 2.

This report section provides an overview of the overall Phase 4A site selection process. A more detailed description of the evaluation processes employed to compare individual sets of options is provided in Chapter 1 in Volume 2.

2.5 ROLES AND RESPONSIBILITIES

The Phase 4A site selection process involved a large number of participants. M.M. Dillon Limited, under the guidance of OWMC, was responsible for the coordination and synthesis of the Phase 4A site selection activities carried out by a team of consultants specializing in geologic, hydrogeologic and geotechnical, surface water, biological, land use, social, economic, air quality and air dispersion, agricultural, transportation risk and engineering concerns. The general roles and responsibilities of Dillon (the site selection coordinating consultant), the risk, environmental and engineering site selection consultants and the Ontario Waste Management Corporation are highlighted in Table 2.2. Each of the site selection consultants was responsible for a number of technical areas. Table 2.3 identifies the firms, the coordinator within each firm and the major areas of responsibility.

Although Tables 2.2 and 2.3 specify the areas of responsibility, judgements made by each of the major participants, generally involved input to and review by other members of the site selection team and OWMC.

This report documents the coordination and synthesis roles of M.M. Dillon Limited. Reference should be made to the reports of the other site selection consultants and of OWMC (see List of References) for a more complete description of the roles assumed by the other participants in the Phase 4A site selection process.

2.6 STUDY AREAS

Six general study areas were identified by the site selection team. These study areas encompass the major risks, impacts and costs which vary among the options.

TABLE 2.2

Phase 4A - Site Selection - Roles and Responsibilities

SITE SELECTION COORDINATION CONSULTANT (M.M. DILLON LIMITED)	SITE SELECTION RISK AND ENVIRONMENTAL CONSULTANTS	SITE SELECTION ENGINEERING CONSULTANTS (MONENCO LIMITED)	OWMC
o technical coordination of site selection team o formulate and apply overall evaluation methodology o synthesis of site selection team inputs o rationale and documentation of methodology and synthesis judgements o incorporation of inputs to site selection from agencies and public as obtained through direct contacts, through other members of the site selection team and through OWMC public consultation activities o presentation of synthesis, findings, conclusions and recommendations to OWMC, agencies and public as requested by OWMC	o participation in joint activities of site selection team o data collection, analysis and interpretation o integration of inputs from subconsultants, agencies and public as obtained through direct contacts and through OWMC public consultation activities o synthesis and documentation within discipline o adaptation of overall evaluation methodology to suit data base o rationale for all technical judgements o presentation of analysis findings, conclusions and recommendations to OWMC agencies and public as requested by OWMC	o engineering analysis - facilities characteristics information, cost, engineering flexibility, events for use in generic risk assessment o suggestions and responses to suggestions, e.g. engineering implications to modify general design and operations to reduce risk, impacts and costs o synthesis and documentation within discipline o adaptation of overall evaluation methodology to suit data base o rationale for all technical judgements involving facility operation and design o incorporation of agency and public input into analysis o presentation of analysis findings, conclusions and recommendations to OWMC agencies and public as requested by OWMC	o final decisions re scope and timing of Phase 4A activities (in response to consultants' recommendations) o final decisions regarding factor identification, factor ranking and refinement and comparison of siting options (in response to consultants' analysis and recommendations) o public consultation o corporate policies, e.g. compensation, mitigation, and review of consultants' outputs in terms of corporate policies and priorities o waste quantities, waste characteristics and technology selection o coordination of contacts with agencies, media and elected representatives o preparation of OWMC documents and public statements with technical input from consultants

TABLE 2.3

Site Selection Consultants' Areas of Responsibility

FIRMS	COORDINATOR	MAJOR AREA OF RESPONSIBILITY
Institute of Environmental Research Inc.	P. Homenuck	- social and community impacts - economic base, municipal service and financial impacts (Clayton Research Associates Ltd.) - tourism impacts (Laventhol & Horwath) (Jack Ellis and Associates Ltd.) - visual impact assessment (EDA Collaborative) - heritage resources (Historica Research Limited)
Leon Kentridge Associates Ltd. (Marshall Macklin Monaghan Ltd.)	L. Kentridge	- existing, planned and proposed land use - land appraisals (Graydon Rogers Appraisals Ltd.)
M.M. Dillon Limited	D. Lawrence (sub-consultant to M.M. Dillon Ltd.)	- site selection coordination
M.M. Dillon Limited	J. Crosby	- transportation analysis - transportation risk
Monenco Ltd.	R. Grant	- engineering and cost analysis options - landfill design (M.M. Dillon Limited)

TABLE 2.3

Site Selection Consultants' Areas of Responsibility

FIRMS	COORDINATOR	MAJOR AREA OF RESPONSIBILITY
Ontario Research Foundation	C. Baynes	- air dispersion/air quality
Ecologistics Ltd. (Deloitte, Haskins and Sells Associates)	D. Cressman	- agricultural resources - specialty and sensitive crops
Environ Corp.	J. Highland	- generic risk assessment
Gartner Lee Associates Ltd.	G. Anderson	- geology - hydrogeology and geotechnical considerations - biology - surface water suitability (with M.M. Dillon Limited) - archaeological resources (Museum of Indian Archaeology)

As indicated in Table A.1, the study areas employed varied depending on the sets of options under consideration. The study areas also varied depending on the site selection factor. The rationale for the study areas chosen by each consultant is contained within the individual consultant's reports.

The general definitions for the study areas are as follows:

2.6.1 SITE

The site acquisition area boundaries of each candidate site define the on-site study area. These are the Phase 3B acquisition boundaries for sites LF-9C, PI-27E, LF-4N, LF-2N and PI-13N. Refined site boundaries were defined in Phase 4A for sites LF-3C, LF-1E and PI-1N.

2.6.2 SITE VICINITY

Site vicinity refers to the study area around each of the candidate sites used to address major, direct off-site effects on individuals, uses and features. Some site selection consultants delineated sub-areas within the site vicinity as a means of addressing gradations of impacts, e.g. visual impacts, or where areas of influence, e.g. noise, could be defined more precisely, or in reference to the distribution of particular resources or features, e.g. downstream areas.

2.6.3. AIR DISPERSION ZONES

These zones were defined by the Ontario Research Foundation for the consideration of air dispersion and air quality risks and impacts. Two concentric zones were employed: 0-5 km for fugitive or low elevation releases and 0-20 km for stack emissions studies.

2.6.4 COMMUNITY AND REGIONAL

The community and regional study area addressed the broader social and economic impacts on the communities and municipalities which encompass the study area. The consultants defined the community and regional study area using well-defined boundaries, e.g. municipalities. Secondary source data were readily obtainable for such areas. Air dispersion zones were also employed as data had already been obtained within these zones. The community and regional study areas selected conveyed an impression of the affected communities adequate for comparative evaluation purposes.

2.6.5 ACCESS ROADS

Access roads in general refers to any and all public roadways in the Ontario road systems over which truck transport vehicles would haul special wastes, additives and reagents, or transfer treated and untreated wastes between physical/chemical treatment plant and incineration plant (PI) sites and landfill (LF) sites. For purposes of transporting special wastes or additives to an OWMC candidate site, the assumed trip origin is the selected centroid of the municipal areas as identified by OWMC in the waste profile tabulation.

Province-wide access roads refers to that component of the access road system from the special waste source municipal centroid location to the selected local and regional access road*. For most of the movements, the junction point between province-wide access and local and regional access is the point of departure from the 400-series highway system.

Local and regional access roads refers to that component of the access road system leading from the 400-series highway system to a candidate site. When the PI and LF are on different sites (partially integrated), the intersite road transport system is also an element of the local and regional access roads system.

During the site selection process, local and regional access road options were investigated, compared and a "preferred access road" selected.

The local and regional access roads were subjected to a detailed analysis of potential risks and impacts. As a result, a number of study areas were defined along the local and regional access system. The outer limit of these study areas was generally an 800 metre band on either side of the access roads, although consideration was given to downstream uses and the number and characteristics of communities within which the routes were located. The 800 metre study zone was used to examine potential impacts resulting from an accident involving tank trailers carrying a flammable solvent (a highly conservative assumption). The 800 m study zone also encompassed the area within which such potential impacts as noise, visual intrusion, traffic interference, changes in traffic safety and land use conflict would largely occur. Within the 800 metre band a series of risk (a 150 metre and a 500 metre band) and impact (noise contours, adjacent, non-adjacent) zones were also defined. These additional zones served to predict different types of impacts and gradations in the magnitude and type of potential risks and impacts.

2.6.6 RAIL ACCESS

Two impact zones were identified for purposes of comparing rail access options to each candidate site. The 170 metre impact zone represents the area flanking each side of a rail spur line within which the maximum noise impacts could be expected to occur. The 250 metre impact zone is based on an assessment of short range catastrophic events, such as explosions and fires.

2.7 TIME HORIZONS

The differences among siting options may vary depending on the time horizon under consideration. The approach to the treatment of time employed in Phase 4A and the considerations which influenced the approach are highlighted in Table 2.4.

2.8 FACILITIES CHARACTERISTICS ASSUMPTIONS

The Phase 4A site selection involved two interrelated streams of activities - one pertaining to the formulation and refinement of facility characteristics, and the other encompassing all activities involved in the identification, prediction and interpretation of risks, impacts and costs. Both activity streams have proceeded on a phased basis with each step progressively more detailed and more focused geographically. The level of detail of the engineering analysis at each stage was, to some degree, dependent on the nature of facilities characteristics information required by the site selection activity stream to determine the relative and absolute suitability of alternative areas and sites for the establishment of the facility components.

The general assumptions regarding facilities characteristics employed in Phase 3B were based on M.M. Dillon Limited's Site Selection Process. Phase 3B: Selection of Candidate Sites - Facilities Characteristics and Technical Buffer Zones (1984a) report and other engineering analyses undertaken by or on behalf of OWMC.

In Phase 4A, the Facilities Development Process refined such matters as waste quantities (characteristics and sources), choice of technologies, emissions and effluents, facility design and operations, on-site facilities and off-site services. These analyses were undertaken by various

TABLE 2.4

Treatment of Time in Phase 4A

CONSIDERATIONS	APPROACH
o the most accurate information regarding uses, features and resources which might potentially be at risk or subject to impacts pertains to existing conditions	o unless forecasts were available to the year 2000, e.g. traffic forecasts, detailed predictions of impacts and risks would be made on the basis of existing conditions and planned changes as expressed through provincial and municipal policy documents, e.g. official plans
o the plant is not expected to open until the year 1991 and is not expected to reach maximum capacity until the year 2001	o a sensitivity analysis would be undertaken based on the formulation of future scenarios developed by the land use, social, economic and agricultural consultants. These scenarios would address broad planned and potential (based on an overview of trends) changes in the characteristics of the areas surrounding each site. These scenarios would then be used to address whether the ranking of the siting options would change once the results of the future scenarios were incorporated into the analysis
o to use the year 1991 as a basis for impact prediction would tend to underestimate potential long-term adverse impacts	o with respect to impact prediction, facility characteristics at maximum facility capacity, i.e. 300,000 tonnes per annum, would be assumed

TABLE 2.4

Treatment of Time in Phase 4A

CONSIDERATIONS	APPROACH
o to use the year 2001 as a basis for impact prediction would tend to overstate potential benefits	o with respect to positive impact prediction, i.e. municipal finance and some economic impact consideration would be given to the relative differences among impacts for both 150,000 tonnes per annum and 300,000 tonnes per annum. It would also be addressed in sensitivity analyses.
o in view of the small construction workforce and the likelihood that most of the construction workforce would commute from existing centres (see Economic Base Report by Clayton Research Associates Ltd.), the impacts of the facility during construction would tend to be somewhat more moderate than during the operations period	o each consultant was asked to consider major construction-related impacts which would vary among options in formulating their conclusions regarding the ranking of options. Construction impacts would also be addressed in a sensitivity analysis.

engineering and specialist consultants to OWMC. The facilities characteristics analyses focused on the items likely to be relevant to the site selection analyses.

The site selection and engineering activity streams are interwoven in a number of significant ways (see Table 2.2 of this volume), including the following:

- the initial base case facilities characteristics assumptions (not adjusted on a site-specific basis) provided the preliminary basis for the identification and prediction of risks and impacts;

- one component of the facilities characteristics assumptions employed in the generic risk assessment (see Environ, 1985) and in the analysis of potential surface and ground water risks was the identification of potential short and long-term releases of contaminants. The consideration of these potential releases was also an iterative process with successive adjustments on the part of both the engineering and risk analysis. These adjustments ensured that the magnitude, frequency and duration of releases would not be underestimated.

- the preliminary prediction of risks and impacts, together with design and operations requirements, provided the basis for design modifications (see Chapter 3, Volume 2);

- constraints identified through the site selection processes were evaluated by the engineering consultant in terms of cost (capital and operating) and design/operations implications. The engineering modifications specific to each site were, in turn, incorporated back into the comparative analysis and the basic acceptability analysis processes;

- where major potential risks or impacts were identified, consideration was given to the modification of facilities characteristics assumptions. The consideration of mitigation focused on those major concerns likely to influence the acceptability of a site or the ranking of siting options. Modifications to facility characteristics assumptions were only made where the site selection team, in conjunction with OWMC, determined that a mitigative measure was both warranted and feasible. In some instances, changes to facility characteristics assumptions were made on a generic basis, i.e. they applied to all sites and in others they were only applied to address a particular problem on a particular site or sites. The implications of these changes to the predictions of risks, impacts and costs and, in turn, to the relative suitability and absolute acceptability of options, were then reviewed;

- in some instances, changes in facilities characteristics assumptions could potentially result in changes in the ranking of options. As previously noted, there remains the possibility of subsequent refinements in facility design and/or operations. A further area of interrelationship between the engineering and site selection activity streams was the conducting of a series of sensitivity analyses. These sensitivity analyses included consideration of facilities characteristics assumptions which changed as a result of the on-going design and development work. This revised information was then used by the site selection team in a series of sensitivity analyses.

In Phase 4A, the engineering consultant, Monenco Ltd., issued two reports - Facility Design Status Report (Monenco, 1985) and Selection of a Preferred Site(s): Engineering (Monenco, 1986). The Status Report describes the type of facility to be built and managed by OWMC. The report outlines information on the design and operations of the facility, at a conceptual engineering level, to the extent that is possible before a specific site is selected.

The Phase 4A engineering report (Monenco, 1986) provides facilities characteristics information supplied to and employed by other members of the site selection team. The report provides engineering information specific to each candidate site. The report describes the engineering inputs in terms of cost, flexibility, basic acceptability and the comparative evaluation of options.

Table A.2 in Appendix A highlights the major facilities characteristics assumptions employed in the Phase 4A analysis and their role in site selection. A more specific description of how these assumptions were employed is contained in subsequent chapters of this report, the Monenco Phase 4A engineering report (Monenco, 1986) and in the individual site selection consultant's reports.

3. PROCESS AND METHODS - REFINEMENT OF SITING OPTIONS

3.1 INTRODUCTION

As noted in Chapter 2, before it was possible to conduct a detailed comparative evaluation of siting options a series of preliminary decisions needed to be made. These preliminary decisions pertained to four aspects of the candidate sites and interrelationships between facility components. They included:

- the refinement of site boundaries for three sites (LF-3C, PI-1N and LF-1E);
- the choice of a preferred access route to each of the sites and, in the case of partially integrated siting options, of routes between facility components;
- the identification of a preferred rail access route to the incinerator-physical/chemical treatment plant for the transportation of additives and reagents;
- the choice, in the case of partially integrated siting options, of whether to place the physical/chemical treatment plant with the incineration plant or with the engineered landfill.

This chapter presents an overview of the general approach employed to address these four sets of choices.

This chapter begins with a brief review of characteristics shared by the four sets of options. The major elements of the general approach employed in the refinement of siting options are then presented. This approach draws upon the general site selection principles and procedures described in Chapter 2. The major ways in which the process and scope of each of the four components was adjusted to reflect the particular characteristics of the choices under consideration are then presented.

3.2 CHARACTERISTICS OF OPTIONS

Although there are a number of significant differences among the four sets of options they do share a number of important characteristics. These characteristics, and their implications for the scope and process employed in the refinement of siting options, are outlined in Table 3.1.

3.3 GENERAL APPROACH

The general approach employed in the refinement of siting options is based on the consideration of the site selection goals, objectives, principles and process.

Table 3.2 highlights these characteristics and their application in the refinement of siting options.

TABLE 3.1

Characteristics of Options

CHARACTERISTICS	IMPLICATIONS
o a relatively small number of choices must be considered	o after discarding clearly unsuitable options can use predicted risks and impacts directly to compare options o potential for considering options in a series of stages where a large number of options makes understanding difficult
o two choices: - identification of a preferred boundary or route - comparison of options	o one procedure for each type of choice
o frequently differences among options quite limited	o focus on identifying and exploring major differences
o generally limited number of facility characteristics involved	o focus on facility characteristics which vary among options
o generally limited geographic area affected	o focus on major risks and impacts in immediately affected area
o some areas of uncertainty regarding data and interpretation	o use additional steps, alternative evaluation methods and sensitivity analyses to test and explore areas of uncertainty

3.4 REFINEMENT OF SITING OPTIONS PROCESS

3.4.1 GENERAL PROCESSES

The site selection process employed in the refinement of siting options pertains to both the interrelationships among the four elements of siting option refinement and to the process used within each element. With respect to the former, the four sets of choices were examined in parallel. The analyses were, however, interrelated. The choice of site boundaries can, for example, influence the placement of access roads and rail lines. The choice of a rail access point can preclude or affect the choice of a road access point. Each analysis was conducted separately. Analyses and conclusions were then modified based on the implications from and for the other analyses. In this way, the conclusions arising from, for example, boundary refinements* are not inconsistent with those reached in the road and rail analyses.

Two basic processes are employed as illustrated in Figures 3.1 and 3.2.

In both cases, a series of factors are identified - at a level of detail sufficient to identify major differences and constraints. The factors generally are drawn, and where appropriate, modified from an overall list of Phase 4A factors (see Chapter 4 in Volume 2). Facilities characteristics assumptions, relevant to the choices and potentially affected environment, are identified from an overall list of Phase 4A facilities characteristics assumptions (See Appendix A in Volume 1).

The data employed in the siting option refinement analysis are largely drawn from the extensive data base compiled for siting option comparison purposes. Only data directly relevant to the choices under consideration are, however, employed. Depending on the concerns addressed, the data are also combined, interpreted and applied in different ways.

TABLE 3.2

Major Elements of Siting Option Refinement Approach

OVERALL PHASE 4A APPROACH	APPLICATION TO REFINEMENT OF SITING OPTIONS
Goals and Objectives	o selection of factors for overall Phase 4A o adaptation of factors and selection of indicators to highlight major differences among options o links factors to goals and objectives
Site Selection Principles	o staged approach o broad definition of environment o emphasis on protection of human health and environment o comments sought from public through direct contact and through the OWMC public consultation program o emphasis given to areas, routes and sites with the greatest potential for suitability o areas of uncertainty and the desire to maintain choices in areas of uncertainty explicitly considered

TABLE 3.2

Major Elements of Siting Option Refinement Approach

OVERALL PHASE 4A APPROACH	APPLICATION TO REFINEMENT OF SITING OPTIONS
Site Selection Process	o major elements of process employed: - identification of factors - data collection and analysis - ranking of factors - issues and tradeoffs - recommendations o through process provision made for: - synthesis and review by site selection team - OWMC review - public and agency input - process staged and documented in traceable manner; conclusions substantiated and support data referenced

FIGURE 3.1

REFINEMENT OF SITING OPTIONS - PROCESSES

CONSTRAINT MAPPING PROCESS

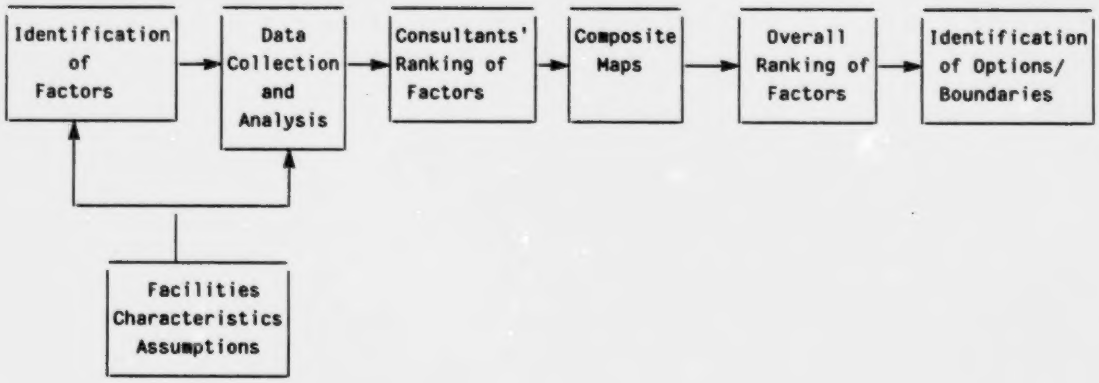
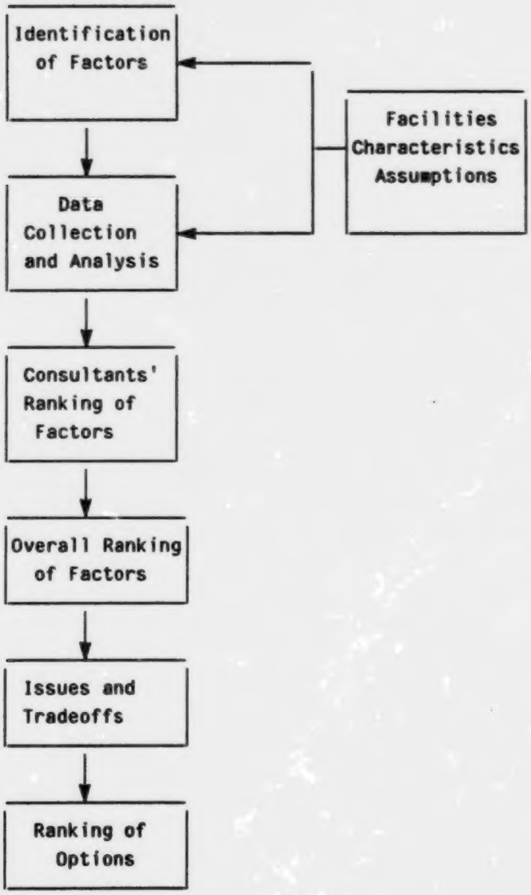

Identification of Factors
Data Collection and Analysis
Consultants' Ranking of Factors
Composite Maps
Overall Ranking of Factors
Identification of Options/ Boundaries
Facilities Characteristics Assumptions

FIGURE 3.2

COMPARATIVE EVALUATION PROCESS


Identification of Factors
Facilities Characteristics Assumptions
Data Collection and Analysis
Consultants' Ranking of Factors
Overall Ranking of Factors
Issues and Tradeoffs
Ranking of Options

To ensure outputs could be combined, consultants ranked their factors, reached conclusions and substantiated their positions. Once an overall ranking of factors was formulated, the constraints or issues were reviewed and overall conclusions reached.

The actual procedure employed varied somewhat depending on the sets of options being considered. In some cases for example, additional steps such as screening, factor aggregation, quantitative cross-checks and staging were employed. These variations, and the rationale for each, are outlined in the following sections.

3.4.2 PROCESS ADAPTATIONS

The refinements and modifications made to the general site selection process outlined in Figure 3.1 are summarized in Table 3.3.

Detailed descriptions of the treatment of the four components of the refinement of siting options are provided in Chapters 4 through 7 in this volume.

TABLE 3.3

Process Adaptations

REFINEMENTS/ADAPTATIONS	REASONS
1. Boundary Refinement	
o The factor ranking and application (constraint mapping) process had three stages: a) absolute constraints b) on-site constraints c) off-site constraints	° In this way it was possible to exclude clearly unsuitable areas first. Consideration was then given to major on-site constraints. Off-site constraints were only considered where distinctions were subtle or to reinforce decisions
2. Rail Access Options	
o A two-stage analysis was employed: a) constraint mapping b) comparative evaluation of rail access options	o The first stage served to identify potential rail access options and the second served to compare the options identified
o In factor ranking and application (in both stages) a distinction was drawn between features to avoid and features to maximize the separation distance from	o In this way routes would be selected which first avoided major constraints and then maximized the separation distances from sensitive areas and features
3. Location of the Physical/ Chemical Treatment Plant for Partially Integrated Siting Options	
o Screening of factors and indicators step was employed in the analysis	o Screening involved excluding factors and indicators because: - a distinction could not be drawn between the two sites - the concern was adequately addressed by another factor

TABLE 3.3

Process Adaptations

REFINEMENTS/ADAPTATIONS	REASONS
3. Location of the Physical/ Chemical Treatment Plant for Partially Integrated Siting Options	
o Preliminary aggregation of factors step was added to the analysis	o The step made it possible to combine similar or associated factors. In this way the analysis could more readily focus on major tradeoffs between options
o In addition to a review of the issues and tradeoffs associated with the options, two cross-checks (one qualitative and one quantitative) were undertaken	o The cross-checks served as a review of the issues and tradeoff analysis
4. Access Road Options	
o A two-stage comparative evaluation process was employed: a) preliminary analysis of access road options b) comparative analysis of access road options	o The preliminary analysis was conducted at a level of detail sufficient to exclude clearly less suitable options. The second level of analysis employed a broader range of factors and was undertaken at a greater level of detail. In this way it was possible to identify preferred access routes
o A screening of factors* step was added to both stages	o Screening involved excluding factors which did not contribute to the analyses because:

TABLE 3.3

Process Adaptations

REFINEMENTS/ADAPTATIONS	REASONS
Access Road Options (Cont'd)	- there were no instances of the feature affected by any of the options - the concern was addressed by another factor - the concern was very minor or mitigable (concerns in this latter group were set aside from consideration in the event that all other factors were approximately equal)
o An aggregation of indicators step was added to the analysis	o This step made it possible to combine interrelated indicators into composite indices
o A preliminary aggregation of factors step was added to the analysis	o The step made it possible to combine similar or associated factors. In this way, the analysis could more readily focus on major tradeoffs between options
o Two cross-checks (one quantitative and one qualitative) were undertaken	o These cross-checks made it possible to explore tradeoffs from a number of perspectives

4.0 REFINEMENT OF SITE BOUNDARIES

4.1 INTRODUCTION

4.1.1 PURPOSE

Three of the candidate sites identified in Phase 3B (LF-3C, LF-1E[1] and PI-1N) were larger than would be required to accommodate the OWMC facilities. It was not possible to reduce the size of these sites to the minimum area required in Phase 3B based on the level of detail of data available at that time.

In Phase 4A more detailed data provided a basis for boundary refinement. Boundary refinement was necessary prior to the detailed comparative evaluation of siting options in order to minimize on-site impacts and to ensure that the sites were approximately the same size and, therefore, comparable. Although it was desirable to minimize the land area required for the facilities, it was also desirable to retain some flexibility should on-site constraints be identified through more detailed investigations. Land area flexibility also responds to requirements arising from refinements and modifications in facility design and operations.[2]

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[1] The entire site was used for the integrated LF-1E option. For the partially integrated siting option, the refined LF-1E was used, as discussed in Section 4.6.3.

[2] A landfill life of approximately 20 years was considered to be the minimum practical size required for landfill sites. At the time the boundaries were refined, landfill life estimates did not include Phase 4A hydrogeologic information. Subsequent to the refinement of site boundaries, the results of the Phase 4A drilling were incorporated into landfill life estimates. This reduced the landfill life potential (Monenco Ltd., 1986).

This chapter documents the process for refining the boundaries for LF-3C, LF-1E and PI-1N. In each case, an attempt is made to balance the desire to minimize on-site and off-site impacts with the need to retain a site large enough to accommodate the facility and technical buffer zone.

4.1.2 OPTIONS

As noted above, the site boundaries were refined for the three largest candidate sites - LF-3C, PI-1N and LF-1E. The revised boundaries identified for these sites were used in subsequent siting option refinement stages and in the comparison of siting options.

With two of the sites (LF-3C and LF-1E), alternative site acquisition boundaries were reviewed in sensitivity analyses to determine whether alternative boundaries might influence the ranking of siting options. These two sensitivity analyses are documented in Chapter 8 of Volume 2.

4.1.3 ORGANIZATION

The method employed to refine the boundaries of the three sites is essentially one of constraint mapping. The chapter begins with an overview of the general approach employed, including a description of the boundary refinement process, the scope and level of detail, the data base, the study areas employed and the relevant facility characteristics assumptions. An overview of the existing environment is then presented. Factors, for use in constraint mapping, are identified and then ranked and applied in a three-stage process. Conclusions regarding each site and maps identifying major constraints, the original and final boundaries are included.

4.2 APPROACH

4.2.1 PROCESS

The constraint mapping procedures employed by the site selection team to refine site boundaries represents a synthesis of on and off-site constraints identified by the individual specialist consultants. Major risks and impacts were identified, mapped and interpreted recognizing facility development requirements. Consistent with Phase 3B, a portion of a site should only be dropped from further consideration in the event that:

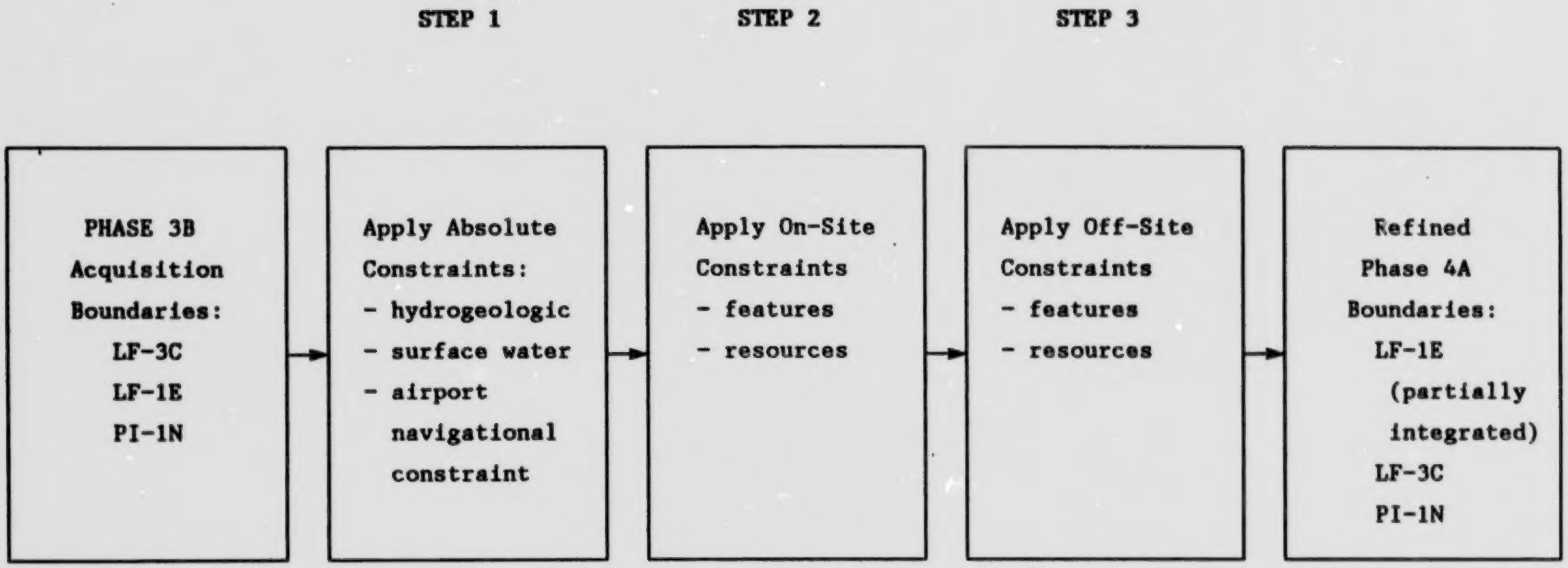
- it is clearly less suitable than the retained portion of the site for all major potential risks and impacts;
- it appears unlikely that there would be a need to retain a high degree of flexibility regarding the placement of the facility components on the site.

The boundary refinement process took place in three steps (see Figure 4.1). First, absolute requirements for facilities development were identified such as confining layer thickness and floodprone areas. Areas not meeting these requirements were excluded from the site area. Second, significant on-site features and resources were identified. Where possible, the boundaries were refined to minimize displacement of these features and resources. Third, off-site features were identified. These features were used to refine site boundaries where on-site features did not clearly result in a preferred revised boundary. Because of the relatively minor changes in boundaries under consideration, few differences in impacts and risks to off-site features was expected. Consequently they were of secondary importance.

FIGURE 4.1

Refinement of Site Boundaries

Constraint Mapping


STEP 1
STEP 2
STEP 3
PHASE 3B Acquisition Boundaries: LF-3C LF-1E PI-1N
Apply Absolute Constraints: - hydrogeologic - surface water - airport navigational constraint
Apply On-Site Constraints - features - resources
Apply Off-Site Constraints - features - resources
Refined Phase 4A Boundaries: LF-1E (partially integrated) LF-3C PI-1N

During steps one and two, consideration was also given to minimizing severances of existing properties. The use of existing property lines, where possible, reduced the number of people affected and the agricultural, social and land use impacts. In particular, consideration was given to removing from consideration large agricultural land parcels.

In steps two and three, criteria for rating the relative importance of the constraints identified by the site selection consultants were defined and applied.

The social and land use consultants (Institute of Environmental Research - IER and Leon Kentridge Associates Ltd. - LKA) applied factors requiring the counting of features on and off-site (e.g. number of residents, number of commercial facilities). In order to facilitate the application of these factors, these consultants subdivided the areas remaining after step one into parcels. Features were then counted within these parcels for use in the comparison of alternative boundaries.

Figures 4.2 - 4.4 indicate the original and revised boundaries for the three sites, as well as the parcels used for comparison by LKA, IER and Monenco Ltd.

4.2.2 SCOPE AND LEVEL OF DETAIL

Inputs to the refinement of site boundaries were obtained from the following consultants:

Consultant	Discipline
GLAL/Museum of Indian Archaeology	- hydrogeology - surface water - biology - archaeology
M.M. Dillon	- airport navigational constraints
IER	- social impact
LKA	- land use
Ecologistics, Deloitte Haskins and Sells	- agriculture
Monenco	- engineering

The boundary refinement analysis focused on a small area on or in the immediate proximity of the three sites. As a result, there were a small number of factors and indicators employed to refine boundaries. These factors and indicators addressed the major constraints and opportunities bearing on the determination of site boundaries. As in other stages of the site selection process, the analysis was undertaken to the level of detail necessary to reach and substantiate conclusions.

4.2.3 DATA COLLECTION AND ANALYSIS

Data were obtained and compiled by each of the consultants on constraint maps or tables. These maps and tables were then reviewed by the site selection team to determine the preferred site boundaries.

Data used in the constraint mapping exercise for refinement of site boundaries were obtained by the consultants from the following sources:

- field investigations (e.g. archaeological resources and biology);
- results of the walk and talk survey (e.g. social impact data, water use);
- on-site drilling program;
- secondary source data (e.g. soil capability, navigational constraint data).

Data used in the constraint mapping process can be found in the individual consultants' reports.

4.2.4 STUDY AREAS

The primary study area used in the refinement of site boundaries was on-site. The site consisted of the acquisition area* identified at the end of Phase 3B.

Several off-site study areas were also used. For the site vicinity impact area, both adjacent and 1000 m study areas were used. For risk factors, two off-site study areas were used. The downstream drainage area to the ultimate receiver basin was used to measure downstream water use. A distance of 4000 m from Burlington Airpark was used to measure navigational constraints at PI-1N. PI-1N was the only site for which this factor was applicable.

Table 4.2 lists the factors and study areas used.

4.2.5 FACILITIES CHARACTERISTICS ASSUMPTIONS

The facility characteristics assumptions used in the refinement of site boundaries and their application are listed in Table 4.1 (Monenco, 1986).

4.3 EXISTING ENVIRONMENT

4.3.1 LF-3C

General Setting

Site LF-3C is located in the Township of West Lincoln. LF-3C was identified in Phase 3B as a potential integrated site (all facilities).

The site is predominantly zoned agricultural. Almost all of the cleared land is actively farmed. There are nine residences on site but no businesses. The site vicinity and community and region are also predominantly agricultural in character, although there are approximately 172 residences and four commercial uses in the site vicinity.

Major On-Site Features

The Beaver Creek flows across the northern third of the site. Archaeological sites have been identified within the creek floodplain.

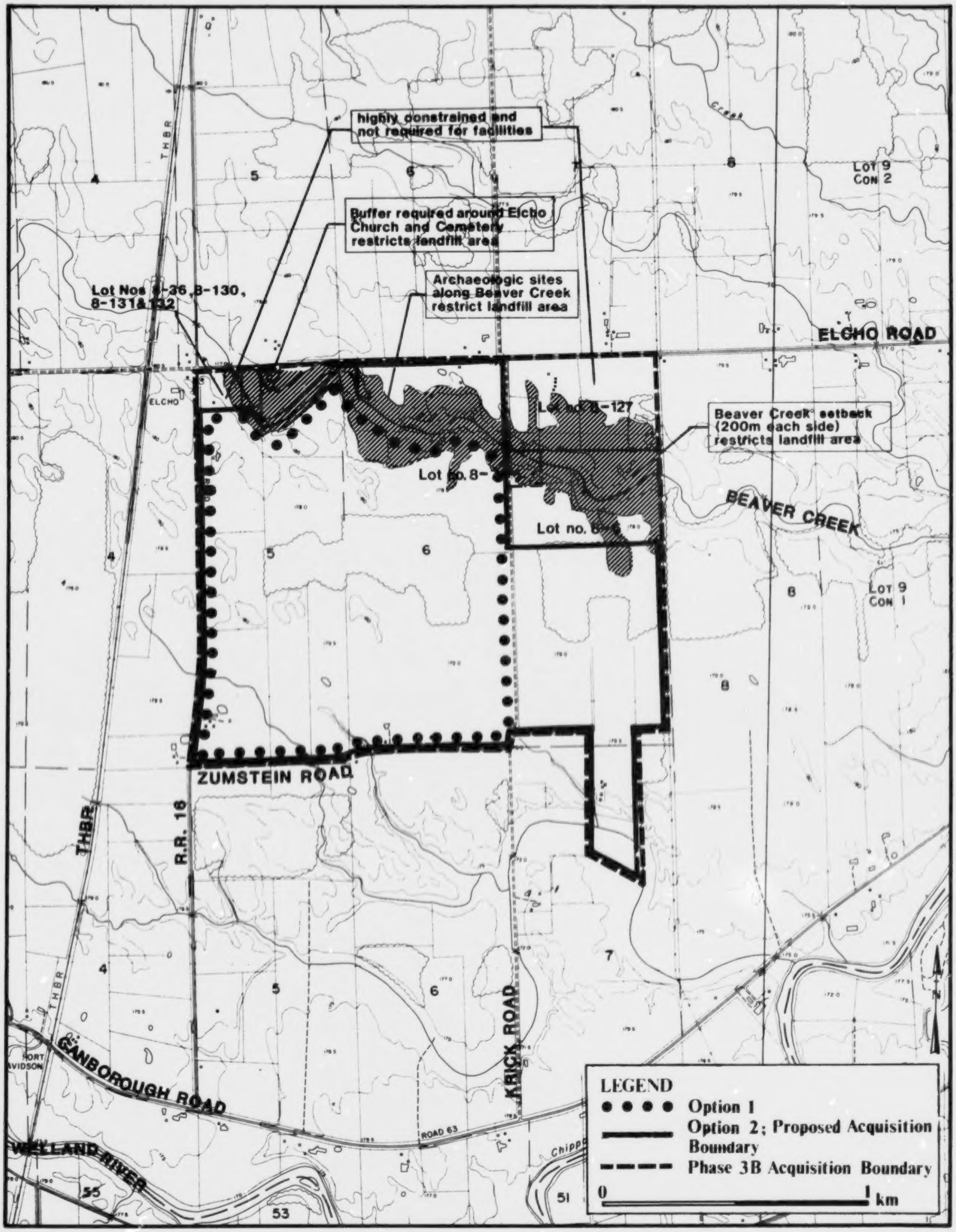
Elcho Church and cemetery are located in the northwest corner of the site.

Several wooded tracts occur on the site which contain significant vegetation species.

TABLE 4.1

Facilities Characteristics Assumptions

FACILITIES CHARACTERISTICS ASSUMPTIONS	ROLE IN ANALYSIS
1. Landfill Excavation Depth ° the site selection process has assumed a conventional landfill ° 8 m for incinerator ° 8 m for physical/chemical treatment plant ° 10 m for landfill	° hydrogeologic constraints preclude areas of the site where natural containment is not adequate
2. Central Operating Area Case 1 ° integrated siting option (all facility components) 17.4 ha Case 2 ° (separate landfill option) physical/chemical treatment plant and incinerator 17.7 ha Case 3 ° separate incinerator 10.7 ha ° physical/chemical treatment plant 10.2 ha	° the area required for operations facilities affects the total site area required including buffer areas, landfill cells, roads, etc.
3. Technical Buffer Zones ° sources of emissions within the central operating area (physical/chemical treatment with solidification, incineration and on-site facilities) will be surrounded by a 400 m wide technical buffer zone ° the engineered landfill will be surrounded by a 50 m wide technical buffer zone	° the area required as a technical buffer is one of the indicators which affects the total site area required for facilities development


highly constrained and not required for facilities
Buffer required around Elcho Church and Cemetery restricts landfill area
Archaeologic sites along Beaver Creek restrict landfill area
Lot Nos 8-36, 8-130, 8-131&132
Beaver Creek setback (200m each side) restricts landfill area
Lot no. 8-127
Lot no. 8-
Lot no. 8-
ELCHO ROAD
ELCHO
BEAVER CREEK
Creek
Lot 9 Con 2
Lot 9 Con 1
THBR
ZUMSTEIN ROAD
R.R. 18
KRICK ROAD
GAINSBOROUGH ROAD
ROAD 63
WELLAND RIVER
PORT DAVIDSON
Chippawa
4
5
6
7
8
51
53
55
LEGEND
● ● ● ● Option 1
Option 2; Proposed Acquisition Boundary
Phase 3B Acquisition Boundary
0
1 km

LF-3C
REFINEMENT OF SITE BOUNDARIES
FIGURE 4.2

Off-Site Features

The settlement of Oswego Park occurs within 2 km of the site. The communities of Wellandport, Bismarck, Winslow, Athercliffe and Moulton Station are located within the community and regional area.

The Welland River runs in an east-west direction approximately 2 km south of the site.

4.3.2 PI-1N

General Setting

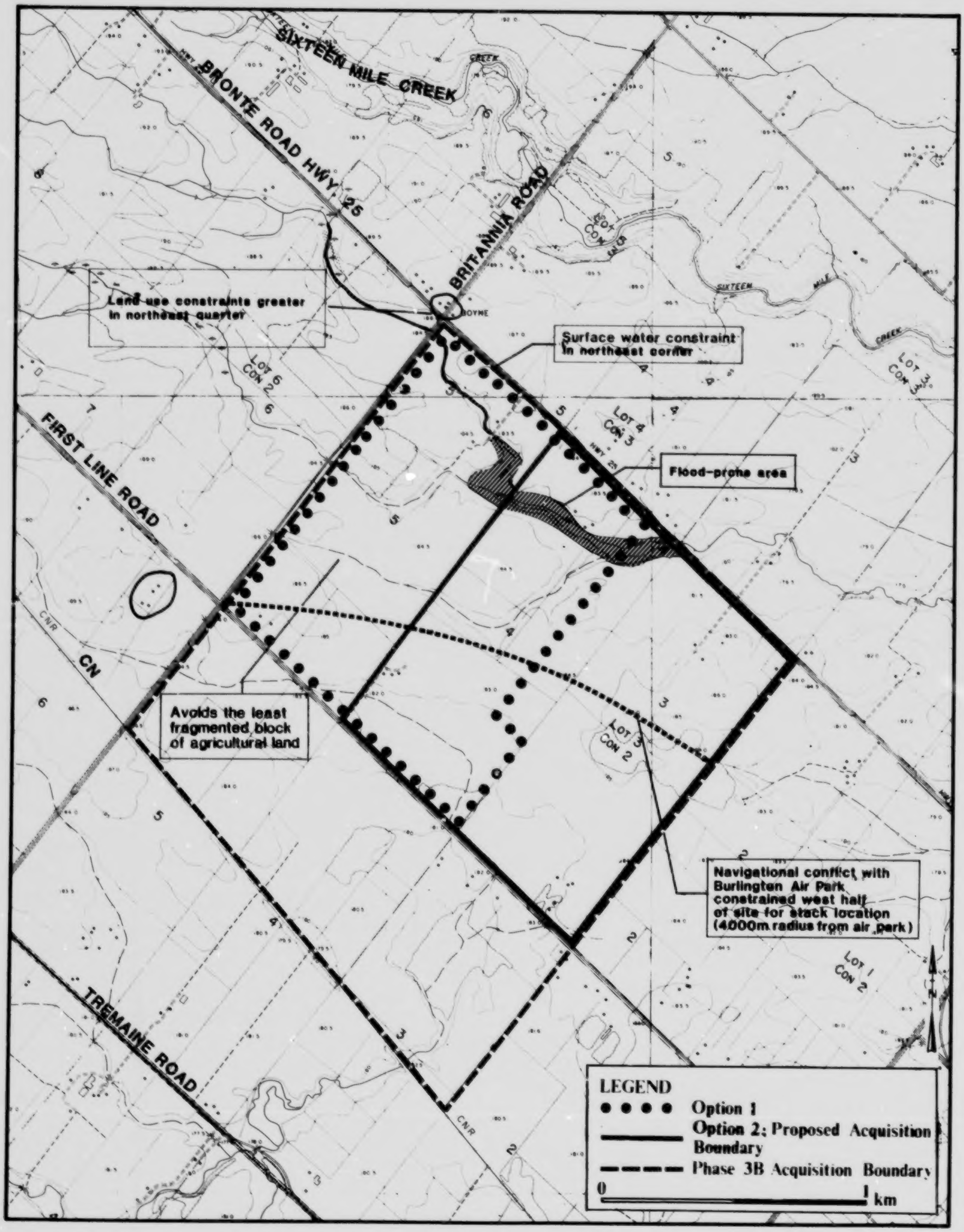
PI-1N is located in the Town of Milton. It was identified in Phase 3B as an incinerator site with potential for location of the physical/chemical treatment plant.

The existing use of the land is predominantly agricultural. There are 12 residences and two commercial uses on site.

The site vicinity is also predominantly agricultural in character. There are, however, approximately 110 residences, seven commercial uses, and one industrial use (abattoir) in the site vicinity. The community and regional area is also largely rural, but includes residential areas within the southern part of rural Milton.

On-Site Features

A tributary of Sixteen Mile Creek crosses the northeast corner of the site. A small tributary of Bronte Creek crosses the site in the southwest corner.


SIXTEEN MILE CREEK
BRONTE ROAD HWY 25
BRITANNIA ROAD
BOYNE
FIRST LINE ROAD
CNR
CN
TREMAINE ROAD
LOT 6 CON 2
LOT 4 CON 3
LOT 3 CON 2
LOT 3 CON 3
LOT 1 CON 2
LOT CON 3
SIXTEEN MILE CREEK
HWY 25
Land use constraints greater in northeast quarter
Surface water constraint in northeast corner
Flood-prone area
Avoids the least fragmented block of agricultural land
Navigational conflict with Burlington Air Park constrained west half of site for stack location (4000m radius from air park)
LEGEND
● ● ● ● Option 1
Option 2: Proposed Acquisition Boundary
Phase 3B Acquisition Boundary
0
1 km
N

PI-1N

REFINEMENT OF SITE BOUNDARIES

FIGURE 4.3

Off-Site Features

The community of Boyne is located at the north-east corner of the site. Sixteen Mile Creek is located approximately 1 km east of the site and Bronte Creek is located approximately 6 km south. Milton is approximately 6 km to the northwest. Burlington Airpark is located approximately 4 km to the southwest.

4.3.3 LF-1E

General Setting

Site LF-1E is located in the City of Niagara Falls. It was identified in Phase 3B as a possible landfill site or as an integrated site (all facilities).

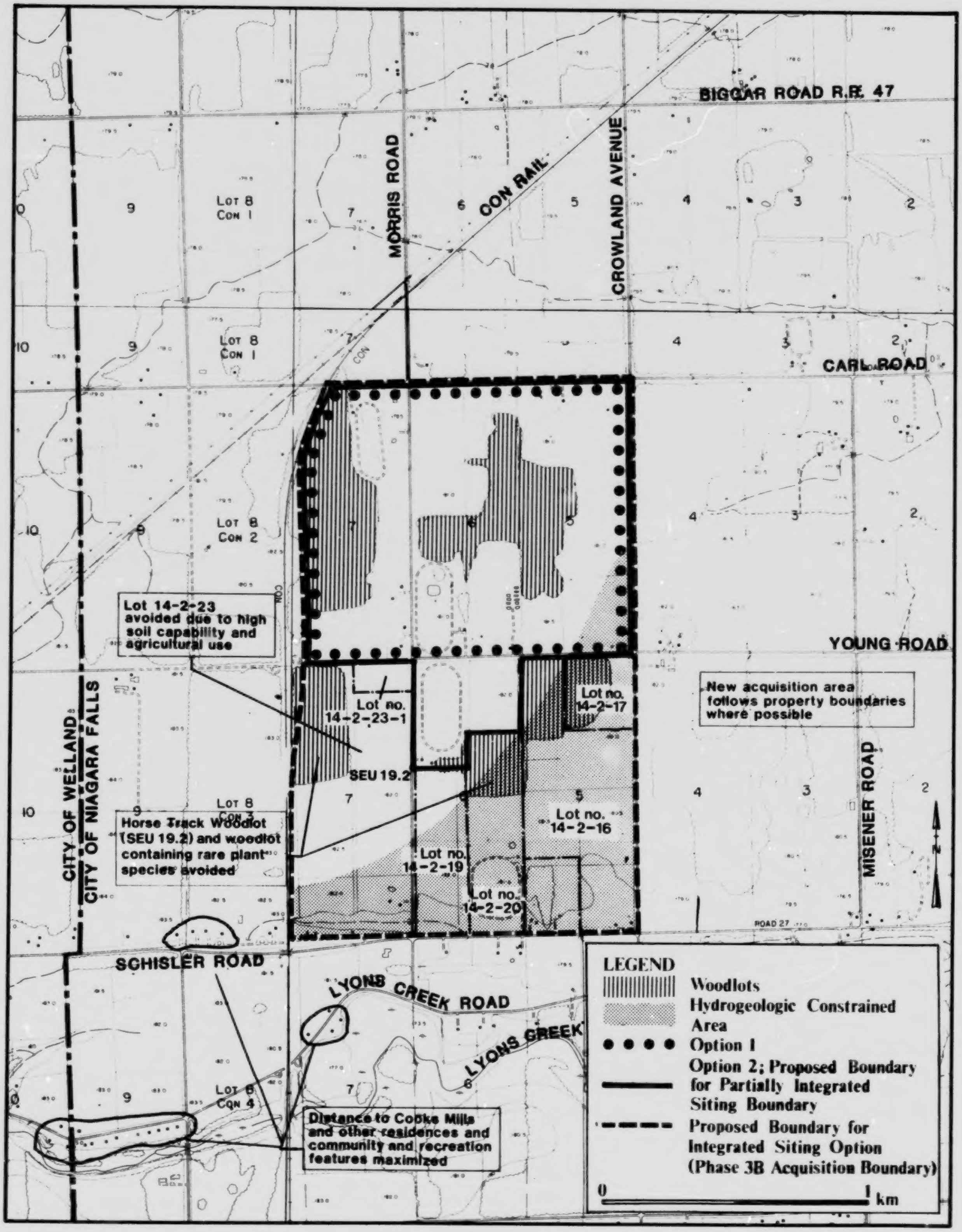
The existing use of the site is predominantly residential and vacant except for a single commercial use and an auto wrecking yard. There are 16 residences on-site.

The site vicinity is also predominantly agricultural in character although there are approximately 215 residences and nine commercial uses in the site vicinity. The community and region area is also predominantly agricultural in nature.

On-Site Features

Significant environmental unit (SEU*) 19.2 (Horse Track Woodlot) occurs in the northern and southern portions of the site.

The ConRail line extends around the west length of the site.


BIGGAR ROAD R.R. 47
MORRIS ROAD
CON RAIL
CROWLAND AVENUE
CARL ROAD
YOUNG ROAD
MISENER ROAD
ROAD 27
SCHISLER ROAD
LYONS CREEK ROAD
LYONS CREEK
CITY OF WELLAND
CITY OF NIAGARA FALLS
Lot 8 Con 1
Lot 8 Con 1
Lot 8 Con 2
Lot 8 Con 3
Lot 8 Con 4
Lot no. 14-2-23-1
Lot no. 14-2-17
Lot no. 14-2-16
Lot no. 14-2-19
Lot no. 14-2-20
SEU 19.2
Lot 14-2-23 avoided due to high soil capability and agricultural use
Horse Track Woodlot (SEU 19.2) and woodlot containing rare plant species avoided
New acquisition area follows property boundaries where possible
Distance to Cooke Mills and other residences and community and recreation features maximized
LEGEND
Woodlots
Hydrogeologic Constrained Area
Option 1
Option 2; Proposed Boundary for Partially Integrated Siting Boundary
Proposed Boundary for Integrated Siting Option (Phase 3B Acquisition Boundary)
0
1 km
N

LF-1E
REFINEMENT OF SITE BOUNDARIES
FIGURE 4.4

Off-Site Features

Lyons Creek runs east-west within 1 km south of the site and then runs north to the east of LF-1E. Cooks Mills and other residences are also located to the south within the site vicinity.

The Welland River is located approximately 3 km north of the site. Commercial, residential and industrial uses occur on both sides of the Welland River to the north.

4.4 IDENTIFICATION OF FACTORS

Table 4.2 contains a composite list of factors applied in the boundary refinement process and the rationale for the use of each factor. Lists of consultants' factors and indicators are contained in the consultants' individual reports, together with the documentation of the process used by each consultant to identify and refine their factors and indicators.

4.5 RANKING OF FACTORS

As mentioned previously, the refinement of site boundaries took place in three steps. Each successive step represented the application of factors considered progressively less important for boundary refinement purposes. First, factors considered to be site requirements were applied. Second, on-site features and resources were compared. Finally, off-site features were used to define site boundaries.

The division of the factors into these three steps represented the only factor ranking necessary for boundary refinement purposes. By addressing the siting constraints in a staged manner, the number of constraints considered for any one site at each stage, was very limited. Thus, it was possible to consider individually the significance and magnitude of each constraint, its potential for mitigation and its potential role in boundary refinement.

TABLE 4.2

Factors Used in Refinement of Site Boundaries

FACTOR	STUDY AREA	RATIONALE FOR FACTOR
A. RISK		
° **Confining layer thickness**	site	° thicknesses will vary across sites and will therefore be useful for on-site comparison ° confining layer thickness will affect provision of second level of protection and can affect potential landfill life of site
° **Susceptibility to flooding**	site	° flooding of operations area could result in rapid movement of toxic contaminants to a watercourse and could pose a risk to downstream users
° **Downstream water uses**	area downstream from site to ultimate receiver waterbody	° minimizing the number of drainage basins within which the facility is situated can contribute to a reduction in the potential risk to water users
° **Navigational constraints for Burlington Airpark**	4000 m from Burlington Airpark	° site PI-1N was identified as having a possible navigational conflict with the Burlington Airpark should an incinerator stack (60 to 100 m in height) be placed on the site.

TABLE 4.2

Factors Used in Refinement of Site Boundaries

FACTOR	STUDY AREA	RATIONALE FOR FACTOR
B. ENVIRONMENTAL IMPACTS		
Site		
° **Displacement of residents**[1]	site	° with alternative site boundaries, the number of residents potentially displaced could vary
° **Displacement of community and recreation features**	site	° potential adverse impacts of displacement, for both users of the feature and the community required to supply alternative features, will increase in proportion to the number of features displaced
° **Archaeological resources displaced**	site	° archaeological resources represent a significant community and provincial resource
° **Commercial land use**	site	° commercial land uses on-site are a measure of potential impacts to business owners on and off-site

[1] The land use consultant (LKA) employed a factor, existing land use, which addressed the displacement of residential and commercial land uses on-site. Although the use of this factor was necessary for the establishment of a land use perspective for site selection team discussion, displacement of residences was screened out in the overall list of factors applied for boundary refinement purposes. The concern with the displacement of residences was addressed by the displacement of residents factors. Commercial land use was maintained as a factor.

TABLE 4.2

Factors Used in Refinement of Site Boundaries

FACTOR	STUDY AREA	RATIONALE FOR FACTOR
B. ENVIRONMENTAL IMPACTS Site - Cont'd		
° Soil capability	site	° Canada Land Inventory Soil Capability Classes for soils with highest crop production potential are a measure of ratings ° areas with high soil capability are less suitable for inclusion within the site boundaries
° Farms with headquarters	site	° identifies active farm operations that could be displaced ° site acquisition areas that avoid farms with headquarters and owned land were favoured
° Cropped land	site	° extent of cropped land indicates the intensity of existing agricultural land use ° the effects on agricultural production of displacing cropped land is greater than the displacement of land which is in a non-agricultural use or is idle
° Rare species	site	° rare species represent a significant potential resource loss

TABLE 4.2

Factors Used in Refinement of Site Boundaries

FACTOR	STUDY AREA	RATIONALE FOR FACTOR
B. ENVIRONMENTAL IMPACTS		
Site - Cont'd		° off-site occurrences were also considered where significant to the interpretation of potential on-site impacts
° **Natural vegetation communities**	site	° natural vegetation communities represent a significant element of the natural environment and are also of potential economic and recreational value ° off-site occurrences were also considered where significant to the interpretation of on-site impacts
° **Fish and wildlife communities**	site	° the areal extent of habitat present influences the variety of species present and the number of individuals which can be supported ° off-site occurrences were also considered where significant to the interpretation of on-site impacts
Site Vicinity		
° **Disruption of and/or use and enjoyment of property and day-to-day activities**	adjacent to site	° where the indicators relating to on-site social impacts failed to identify differences among alternative site boundaries sufficient to warrant boundary changes, consideration was given to the

TABLE 4.2

Factors Used in Refinement of Site Boundaries

FACTOR	STUDY AREA	RATIONALE FOR FACTOR
B. ENVIRONMENTAL IMPACTS		
Site Vicinity - Cont'd		
		differences in the potential disruption of residents living adjacent to the site boundaries
° **Disruption of operations of community and recreation features**	adjacent to site	° **where the factors for impacts on residents and on-site features failed to identify differences among potential site boundaries sufficient to warrant boundary changes, consideration was given to the differences in the potential disruption of the operations of community and recreation features**
° **Existing land uses**	within 1000 m of site boundaries	° **residential and commercial uses close to the site could potentially be impacted by on-site facilities**
C. ENGINEERING FLEXIBILITY		
° **Site area**	site	° **alterations to site boundaries can affect the potential length of landfill life of the facility and flexibility for the application of alternative landfill design features**

TABLE 4.2

Factors Used in Refinement of Site Boundaries

FACTOR	STUDY AREA	RATIONALE FOR FACTOR
C. ENGINEERING FLEXIBILITY		
° Site area (Cont'd)		° a minimum landfill life of approximately 20 years was employed for boundary refinement purposes ° the site area must be large enough to accommodate the facility and technical buffer zone.

The greater importance placed on on-site features (rather than adjacent) varies from the final ranking applied for siting option comparison (see Volume 2, Chapter 5). The differences in off-site impacts for boundary refinement are very minor because of the small geographic changes being considered.

Step 1 - Absolute Requirements for Site Boundaries

These factors were identified as representing absolute requirements of the site area:

1. A confining layer thickness of 10 m or greater was considered necessary for landfill sites in order to ensure a second level of natural protection for the site.

2. Floodprone areas were considered unacceptable for facilities development.

3. A navigation conflict was identified for part of site PI-1N where the incinerator stack would be in conflict with Burlington Airpark.

4. An approximate site life of approximately 20 years was considered to be the minimum practical.[1]

The portions of the sites that met these absolute requirements were considered further in Step 2.

Step 2 - On-Site Features and Resources

On-site features and resources are of greater importance than off-site features because the small differences in site boundary locations considered produce minimal changes in off-site impacts (e.g. noise, odour, use of community and recreation features).

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[1] Landfill lives were preliminary at the time of boundary refinement. Subsequent to boundary refinement landfill lives were revised.

On-site features considered included residents, community and recreation features, commercial facilities, archaeological features and farms with headquarters. The number of features and their significance were considered in defining the preferred site boundary.

On-site resources included farmland (soil capability), cropped land, rare species*, natural vegetation communities, fish and wildlife communities. The area and significance of each resource were considered in defining the preferred site boundary.

Step 3 - Off-Site Features and Resources

The off-site features, assessed in Step 3, were residents (adjacent and within 1000 metres of the site boundaries), community and recreation features and commercial uses. Off-site natural features were also taken into consideration when they were determined significant. The area, number and significance of each feature, and the proximity of features to the site were considered in defining the preferred site boundary.

4.6 APPLICATION OF FACTORS

4.6.1 LF-3C

Step 1 - Absolute Requirements

Most of the Beaver Creek floodplain, which runs east-west across the north part of the site, was removed from consideration because of the surface water risk potential (GLAL, 1985c). In developing the new boundary, property lines were followed where possible. This procedure resulted in the retention of Lot 8-129 containing Beaver Creek in the north-central portion of the site. The floodplain, together with an area extending 200 m southward from Beaver Creek, was precluded for facilities development use.

Avoidance of the Beaver Creek floodplain provides the additional benefit of protecting possible pike spawning in Beaver Creek and one rare species in the floodplain area. In addition, by removing Lots 8-36 and 8-130 to 132 from consideration in the northwest, Elcho Church and cemetery are avoided. Finally, several significant archaeological resources in the Beaver Creek floodplain are avoided.

The floodplain limits defined for boundary refinement purposes are approximate. More detailed analyses could necessitate a moderately greater setback from Beaver Creek. Major changes to such boundaries are not anticipated. Any flooding risk to the balance of the site is mitigable. Nevertheless, a greater setback requirement from Beaver Creek reduces potential landfill life.

In addition, unanticipated hydrogeologic constraints could be identified with more detailed investigation which might preclude the development of a portion of the site. This eventuality is unlikely, given the consistent hydrogeologic conditions identified in the area.

The landfill life for LF-3C, excluding the floodplain areas, is estimated to be 19 years. If the site area were further reduced, the landfill life would drop below 19 years (for total solidification) (Monenco, 1986)[1]. In view of the desirability of achieving approximately 20 years of landfill life, LF-3C might only be suitable for partial solidification disposal options. In addition, site life could restrict the potential for adopting a shallow entombment landfill design.

The boundary area remaining after the surface water requirements were applied was, therefore, maintained. This conclusion was reviewed with respect to on-site and off-site features to ensure that major potential impacts were not overlooked.

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[1] Subsequent to boundary refinement, a sensitivity analysis was undertaken to review the implications of reducing the area of siting option LF-3C (see Volume 2, Chapter 8, and Monenco, 1986).

Sensitivity analyses were also undertaken to determine whether the ranking of siting options would change if the site boundaries excluded the area east of Krick Road and included consideration of alternative engineering options. The results of these analyses are detailed in Chapter 8 in Volume 2.

Step 2 - On-Site Features

Step 1 succeeded in removal of the portions of the site containing the most significant features and resources.

The advantages of maintaining a larger site area were balanced against the following on-site impacts:

- the displacement of a woodlot (east of Krick Road) considered the most significant on-site. It contains Pin Oak, Tupelo and Southern Arrow-Wood which are regarded as rare species;

- a small increase in the number of residents displaced (35 versus 29 residents displaced if remaining site was reduced to west of Krick Road, Option 1 on Figure 4.2);

- no commercial uses.

The number and significance of the impacts associated with the remaining site area for LF-3C do not outweigh the advantages of a 20-year landfill life for the facility.

Step 3 - Off-Site Features

No major constraints were identified off-site that would be helpful in boundary refinement. No major potential changes in impacts on residents, community and recreation features or commercial uses were identified off-site.

4.6.2 PI-1N

Step 1 - Absolute Requirements

The first step assessed the navigational conflict between Burlington Airpark and an incinerator stack located at PI-1N. The western two-thirds of the site falls within a 4000 m navigational radius from Burlington Airpark. This privately-owned airport is located southwest of PI-1N. The transportation consultant determined that a stack height of greater than 40 m would create a severe navigational conflict with the Airpark (MMD, 1985b). This creates a constraint with the western half of PI-1N because the OWMC incinerator stack will be a minimum height of 60 m. The western half of the site was removed from further consideration, based upon the constraints associated with the Burlington Airpark. The eastern half of the site is also preferred, from a surface water perspective, because floodplain and floodprone areas are avoided, outlet capacity is increased and the facility would lie in only one drainage basin. Drainage into Sixteen Mile Creek, instead of Bronte Creek, is also preferred on the basis of fisheries significance (GLAL, 1985a).

No clear preference for facility siting is evident based on hydrogeologic constraints (GLAL, 1985b).

Step 2 - On-Site Features

Both the northeast and southeast quarters of the site are of sufficient size for facility placement including the 400 m buffer zone. These two options follow existing property lines.

The following on-site features and resources determined which of these eastern options was preferred:

1. The northeast corner of the original boundary would result in the displacement of one less resident than the south-east. The characteristics of the residents on the north-east corner were also such that they were expected to be slightly less affected (fewer elderly residents, fewer homeowners).

2. The potential impact on community and recreation features through displacement would be slightly greater for the northeast parcel. There are three possible historic buildings that could be displaced from each option, but Hunterbrook Farms, a horseriding establishment, is located on the north-east parcel.

3. The north-east parcel has one more commercial feature (riding stable).

4. Large farmed parcels in the northeast would be avoided by selecting the southeast portion of the site. This portion contains three parcels, one of which is greater than 30.5 hectares in size. The remaining two parcels are between 12.5 and 50.5 hectares in size. The Canada Land Inventory soil capability classes in these parcels are variable, with approximately one-half in capability classes one or two.

The on-site features indicate a slight preference for the south-east parcel. The north-east parcel is preferred for the displacement of residents. It would, however, involve greater impact on community and recreation features, commercial features and agriculture. The displacement of one additional resident is not sufficient to outweigh the combined impacts on commercial, community and recreation features and agriculture. The southeast corner of the site is, therefore, preferred.

Step 3 - Off-Site Features

The following off-site features and resources were reviewed in Step 3:

- land use constraints are greater in the northeast portion due to proximity to Boyne and other residences;
- there are half as many adjacent residents for the northeast parcel than for the southeast;
- one fewer commercial operation is within 1000 m of the northeast parcel (riding stable).

No clear preference is apparent from the off-site features. The north-east parcel is preferred with regard to proximity to Boyne and other residences, but is less favoured with regard to nearby residents and commercial features.

4.6.3 LF-1E

Step 1 - Absolute Requirements

The preliminary results of the Phase 4A hydrogeologic investigations resulted in the exclusion of the southeast portion of the site from consideration for landfill (GLAL, 1985b). As pointed out in Gartner Lee's report, the confining layer thickness of this portion of the site appears to be less than 10 m. As a result, natural containment would not be assured with landfill development on this portion of the site.

Based on this constraint, with a partially integrated facility (landfill only or landfill together with a physical/chemical treatment plant), the facility components should be largely confined to the northern half of the site, although a small portion of the south half of the site would be required. The extent of the area required would depend on landfill life requirements, impacts and risks.

With the additional land area required for a fully integrated site, the landfill would have to intrude somewhat further into the southern half of the site if the potential for a landfill life of approximately 20 years was to be maintained. The boundaries of the hydrogeologic constraints are approximate. Hydrogeologic conditions in the area are variable. Geotechnical requirements could change with more detailed investigations and could possibly reduce the area of the site suitable for facilities development.

The portions of the lots in the southern half of the site, required for site development, could not be specified with the totally integrated options. Property boundaries do not follow the hydrogeologic constraint. As a result, portions of all properties could be required for facilities development (see Figure 4.4). In view of the property boundaries on the south half of the site and the hydrogeologic constraint, the Phase 3B site acquisition area should be retained for the total integrated siting option. In this way:

o the potential for retaining 20 years of site life would be retained;

o on-site impacts would not be underestimated.

The extreme southern and eastern portions of the site should, however, not be developed for landfilling purposes. Acquisition might be necessary based on property boundaries.

As with LF-3C, a sensitivity analysis was undertaken (see Chapter 8 in Volume 2). In this analysis, rather than using the original acquisition area, the boundary of LF-1E was changed to the LF-1E partially integrated boundary (see Figure 4.4), together with Lots 14-2-23-1 and 14-2--23 in the western side of the site. The sensitivity of the relative ranking of the LF-1E integrated siting option to this potential boundary change was then checked.

Although the original acquisition boundaries should be maintained for the LF-1E integrated option, there does appear to remain some potential for refining the site boundaries for the LF-1E/PI-27E partially integrated siting option[1]. As previously noted, with a partially integrated siting option, a smaller land area would be required.

Step 2 - On-Site Features

In Step 2, the southern boundary for the partially integrated siting option was determined. The following on-site features and resources were considered in defining the site boundary in Step 2:

- o the remaining area of the site should be maximized to allow for a site life of approximately 20 years and to enable flexibility, should further constraints be identified;
- o relatively high soil capability and main commercial farm on Lot 14-2-23 in the south-west corner of the site;
- o higher proportion of non-agricultural land and lower soil capability for dominant soils in the north portion of site;
- o SEU 19-2 (Horse Track Woodlot) along the western boundary of the site, and the woodlot in the east central portion of the site, south of Young Road;

---

[1] At the time that the site boundary refinements occurred, landfill lives of greater than 20 years were identified for portions of LF-1E for both the integrated and partially integrated options for total solidification. Subsequently, the landfill lives were reviewed based on the results of the drilling program. Based on the hydrogeologic and geologic results, landfill lives of less than 20 years were identified for all total solidification options for LF-1E (Monenco, 1986).

- preference to locate the facility in the north portion of the site to avoid surface water swale near Regional Road 27, confine drainage to one (northern) basin and minimize upstream area contributing to runoff.

All of these features are of significance in defining the southern site boundary. The boundary avoids the preferred agricultural Lot 14-2-23 in the southwest corner. The portion of SEU 19-2 (Horse Track Woodlot) south of Young Road and the east-central woodlots are also avoided. In addition, the boundary maintains facilities within one northern drainage basin. By including the portion of land south of Young Road, in addition to the entire north half of the site, landfill life could be extended for the partially integrated facility.

The additional social impacts on residents and community and recreation features of adding a portion of the site south of Young Road are minor (Options 1 and 2, Figure 4.4). The addition to the portion of the site south of Young Road results in the potential displacement of two additional residents.

Step 3 - Off-Site Features

The following off-site features and resources define the site boundary in Step 3. These features reinforce the boundary decisions made in Steps 1 and 2 by:

- maximizing the distance between Cooks Mills and other residences to the south

- maximizing the distance to Lyons Creek Valley to the south of site LF-1E which is an important off-site wildlife habitat feature.

4.6.4 CONCLUSIONS AND RECOMMENDATIONS

The site boundaries for LF-3C, LF-1E and PI-1N were refined.

In a three-step process, absolute (navigational, hydrogeologic and surface water) requirements, on-site and off-site features and resources were identified and evaluated for each site. Constraint maps were used to eliminate areas of the sites least suitable for OWMC facilities.

For site LF-3C, two sections of the site in the northeast and northwest corners were eliminated. This decision was principally based on the consideration of flooding constraints. The remaining site area was required for a 20-year landfill life and operations area. No major constraints were identified. The moderate constraints are not sufficient to counter-balance the landfill life factor.

The southeast portion of LF-1E was identified as hydrogeologically constrained. Of the remaining area, a minimum of the north half of the site is required for partially integrated facilities development. A site boundary for the partially integrated siting option is defined south of Young Road to avoid agricultural, biological, land use and social constraints. For the fully integrated option, the original Phase 3B area is required for facilities development and landfill.

For PI-1N, a navigational constraint between the incinerator stack and Burlington Airpark was identified. This constraint reduces the potential site area to the east half of PI-1N. Of the remaining area, the southeast quarter is marginally preferred based on social, agricultural, surface water and land use constraints.

Figures 4.2 to 4.4 identify the major constraints associated with boundary refinement for each site, the original and final boundaries and the options compared by the social, land use and engineering consultants.

5.0 ACCESS ROAD OPTIONS

5.1 INTRODUCTION

5.1.1 PURPOSE

The identification of preferred access routes from the 400 series highways to each siting option and transfer routes between PI and LF sites was a necessary prerequisite to the comparison of siting options. The access road analysis compares the local and regional access road options remaining at the end of Phase 3B, as well as additional local and regional routes identified by the transportation consultant in Phase 4A.

5.1.2 STEPS

The comparison of access route options in Phase 4A consisted of two levels of analysis. The first level, or the preliminary analysis of access route options, examined all access routes remaining after the elimination of some options in Phase 3B.

The second level of analysis, or the Phase 4A analysis of access route options, resulted in the selection of preferred access routes for each siting option. This analysis was based on a much broader range of factors and consequently required a more detailed data base.

Access road decisions for LF-3C, LF-1E and PI-1N were dependent on the refinement of site boundaries for these sites (see chapter 4).

A listing of preferred access roads selected in Phase 3B is provided in Table 5.1.

5.1.3 ORGANIZATION

This chapter addresses both the preliminary Phase 4A and the Phase 4A access road analysis. Essentially the same format is employed for each of the two steps. An overview of existing environmental conditions in the vicinity of both sets of options is presented. The general approach employed in terms of options, process, scope and level of detail, data collection and analysis, study areas and assumptions is described. The ranking and application of factors are then outlined. Finally, conclusions are presented.

5.1.4 EXISTING ENVIRONMENT

The following provides an overview of the existing environment potentially affected by the access road options in Phase 4A. Map 1 and Map 2, found at the back of this report, illustrate the main access road features for access roads examined in the second level of analysis or the Phase 4A analyses of access road options and for the preferred access roads identified in Phase 3B.

(a) LF-2N/PI-1N

The access road options to PI-1N involve a common stretch on Fourth Line south from Highway 401. Option 1 follows Britannia Road to PI-1N. There

TABLE 5.1

Preferred Access Routes Selected in Phase 3B[1]

1. LF-2N/PI-1N

   a) to LF-2N

   - From 401 - north on Highway 10 to LF-2N;
   - From 410 - west on Derry Road West to LF-2N.

   b) to PI-1N

   - From QEW - north on Highway 25 (Bronte Road) to PI-1N.

2. LF-2N/PI-13N

   a) to PI-13N

   - From QEW - north on Highway 25 (Bronte Road); east on Britannia Road; south on Fifth Line Road to PI-13N.

3. LF-4N/PI-1N

   a) to LF-4N

   - From QEW - north on Highway 25 (Bronte Road); west on Britannia Road to LF-4N.

   b) PI-1N to LF-4N

   - West on Britannia Road to LF-4N.

4. LF-4N/PI-13N

   a) PI-13N to LF-4N

   - North on Fifth Line; west on Britannia Road to LF-4N.

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[1] This listing represents those siting options for which no further options remain. Although preferred access routes were also noted in Phase 3B for siting options such as LF-9C, a final access route could not be selected in Phase 3B. Any siting option for which access route options remain is described in this chapter.

are few residents adjacent to Britannia Road. Option 2 involves travel on Derry Road and Highway 25 to PI-1N. Portions of Derry Road cut through the Town of Milton (population 29,591).

Both options involve a crossing of Sixteen Mile Creek.

(b) LF-2N/PI-13N

Access route Options 1, 2, and 3 between PI-13N and LF-2N involve travel on provincial Highway 401.

There are few people living along access route Option 2. A moderate number of people live along Option 3. Option 4 passes through Meadowvale West. Option 4 has a large number of adjacent community and recreation features including Bethel United Church and Cemetery, Derrydale Golf Course, Meadowvale Public School, Drumquin Park and The Horse Place. Options 2 and 3 have few adjacent community and recreation features. Option 1 has a moderate number of adjacent community and recreation features. There are a moderate number of farm complexes along all intersite transfer routes. Specialty crops are associated with Option 4. All access road options involve crossings of Sixteen Mile Creek.

(c) LF-4N/PI-1N

Both access road options to LF-4N pass a moderate number of residents. Option 1 passes through Omagh and Boyne - two very small rural clusters. Option 2 passes through Boyne and Milton. Both options cross Sixteen Mile Creek. Option 1 crosses Bronte Creek.

The intersite transfer route between PI-1N and LF-4N involves travel along Britannia Road. Option 1 involves travel through Boyne. Option 2 avoids Boyne.

(d) LF-4N/PI-13N

Both options to LF-4N have a moderate number of residents along the access route. Option 1 passes through Omagh and Boyne. Option 2 passes through Boyne and Milton. Both options involve crossings of Sixteen Mile Creek. A part of Option 1 runs along the bank of Bronte Creek.

The intersite transfer route between PI-13N and LF-4N involves travel north on Fifth Line and west on Britannia Road from PI-13N. This access route has approximately 10 active farm complexes and a relatively low livestock population.

(e) LF-3C

The access road options considered in Phase 4A follow Regional Road 24 through Vineland, (population 1,150) or Regional Road 18 through Beamsville (population 5,000) or Regional Road 14 through Grimsby (population 16,000) and Smithville (population 2,000).

With the exception of these communities, the access roads traverse basically rural lands.

A number of community and recreation features are located adjacent to the access road options in these communities. Outside of these communities there are few adjacent community and recreation features.

The portions of Regional Roads 18 and 14 north of the escarpment run through areas of orchards and vineyards. The areas south of the Escarpment traverse areas with a mix of cash crop, dairy and poultry farms. The stretch of Highway 20 between Regional Road 24 and Regional Road 27 is heavily travelled by farm machinery and service vehicles.

Krick and Elcho Roads are the principle local access options. There is a high density of farms on Elcho Road. Beef, dairy, hog, mixed livestock, cash crop and mixed crop operations are located along Option 1. Option 2 passes dairy and poultry operations. One farm operator uses Krick Road to walk his dairy cattle to properties bordering the road.

Access road Options 1, 5 and 6 involve a crossing of Twenty Mile Creek.

(f) LF-9C

The access road options considered in Phase 4A follow either Regional Road 24 through Vineland (population 1,150) or Regional Road 18 through Beamsville (population 5,000). The access roads traverse primarily rural lands. There are a large number of community and recreation features adjacent to Regional Road 24 through Vineland.

A proposed recreational trailer park is located on Highway 20, east of LF-9C. The portion of Highway 20 between Regional Road 24 and LF-9C is bordered by residential cluster development.

The portion of Regional Road 18 north of the escarpment runs through areas of orchards and vineyards. The portion south of the escarpment traverses areas with a mix of cash crop, dairy and poultry farms. Orchards and vineyards are found south of the escarpment on Regional Road 24 through Vineland. The stretch of Highway 20 between Regional Road 24 and Regional Road 27 is heavily travelled by farm machinery and service vehicles.

All access road options to LF-9C involve crossings of Sixteen Mile Creek and Twenty Mile Creek.

(g) LF-1E

The access road options considered in Phase 4A all involve travel on Regional Road 47 (Lyons Creek Road/Biggar Road) from the QEW. Various local access road options including Carl Road, Morris Road, Crowland Road, Young Road and Schisler Road were examined.

Generally, there are few people living adjacent to the access road options. Community and recreation features adjacent or in the vicinity of the access road options include the Arpad Hungarian Cultural Centre, Willo-Dell Golf & Country Club and McCredie Cemetery.

The common portion of the access roads, along Regional Road 47, between the QEW and Regional Road 98 is not farmed. Beef and horse operations, mixed farming and cash cropping are found along Carl Road. Crowland Road is used extensively for farm machinery movements.

Option 5 involves a crossing of Lyons Creek.

(h) LF-1E/PI-27E

The access road options considered for intersite transfer routes in Phase 4A all involve travel on Regional Road 47 (Lyons Creek Road/ Biggar Road) from the QEW. Various local access road options including Carl Road, Morris Road, Crowland Road, Young Road and Schisler Road were examined.

There are few people living adjacent to the access road options. Community and recreation features adjacent or in the vicinity of the access road options included the Arpad Hungarian Cultural Centre, Willo-Dell Golf and Country Club and McCredie Cemetery.

The common portion of the access roads, along Regional Road 47, between the QEW and Regional Road 98 is not farmed. Beef and horse operations, mixed farming and cash cropping are found along Carl Road. Crowland Road is used extensively for farm machinery movements.

Access to PI-27E is via Regional Road 47 (Lyons Creek Road/Biggar Road) via the QEW.

5.2 PRELIMINARY PHASE 4A ANALYSIS OF ACCESS ROUTE OPTIONS

5.2.1 APPROACH

5.2.1.1 Process

Figure 5.1 illustrates the process employed in the preliminary Phase 4A analysis of access road options. The first step in the process involves the identification of factors by the individual site selection consultants. These factors define the scope of work of the data collection and analysis activities.

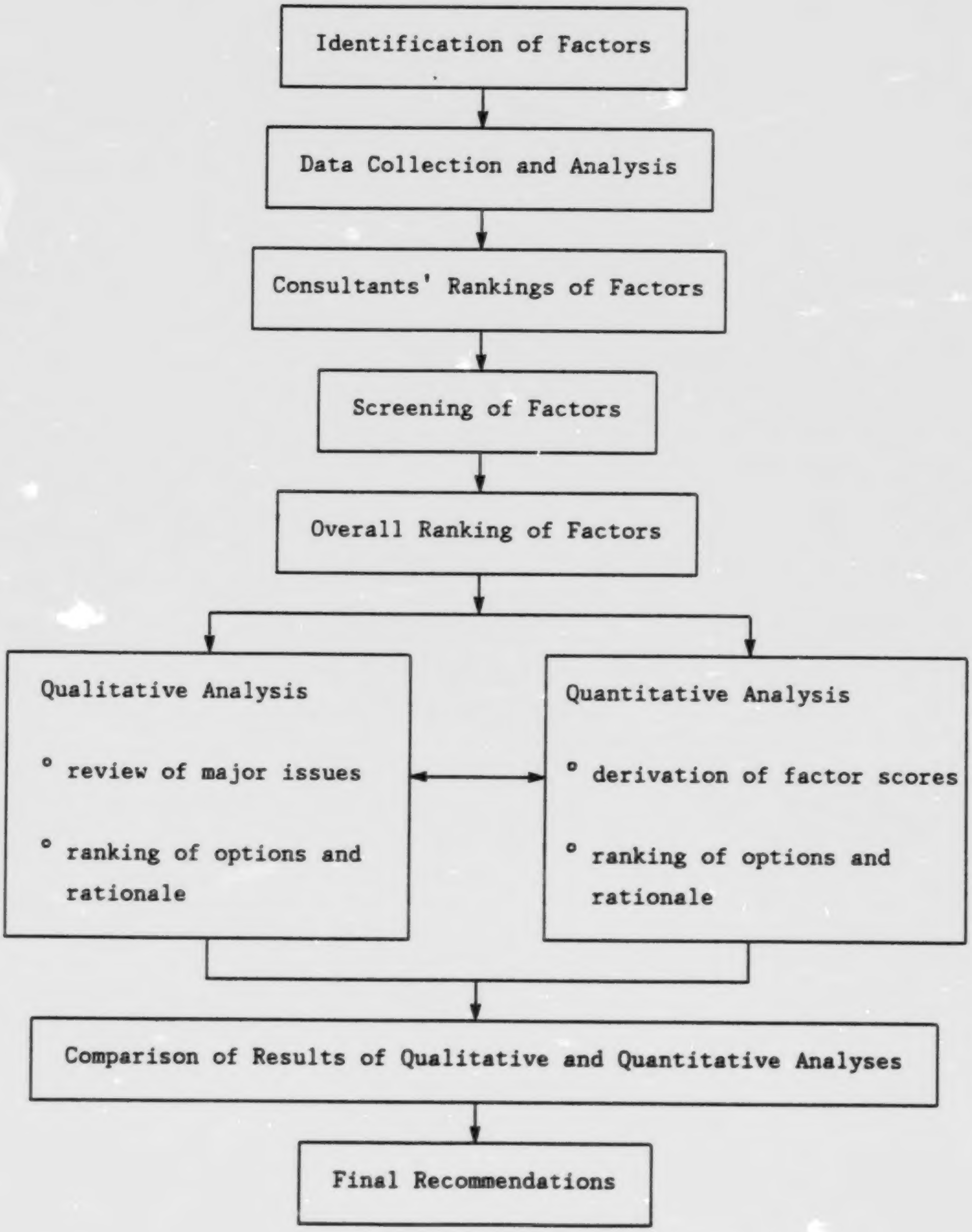
Each consultant collected data for their factors. The data were compiled in a set of data matrices.

Each consultant ranked their factors and provided a rationale for their rankings. Each site selection consultant then used the factor rankings and the differences among the access routes to rank the access road options. The options were ranked from most to least preferred. Where there were no differences or relatively minor differences between or among access road options, the options were ranked at the same level.

Data were synthesized by Dillon Site Selection. A series of composite data matrices were prepared. Based upon a review of the data matrices and the evaluation procedures undertaken by the individual site selection consultants, it became apparent that certain factors were not necessary for the overall comparative analysis. Dillon Site Selection screened such factors. It also provided a rationale as to why the factors were not considered.

FIGURE 5.1

Process Employed in Preliminary Phase 4A Analysis of Access Road Options


Identification of Factors
Data Collection and Analysis
Consultants' Rankings of Factors
Screening of Factors
Overall Ranking of Factors
Qualitative Analysis
° review of major issues
° ranking of options and rationale
Quantitative Analysis
° derivation of factor scores
° ranking of options and rationale
Comparison of Results of Qualitative and Quantitative Analyses
Final Recommendations

An overall ranking of factors was derived. Based on this ranking of factors and a review of the major issues associated with each access road option, the access road options were ranked. A rationale for the ranking was also provided.

A quantitative procedure was formulated and employed as a cross-check to the qualitative review of issues and tradeoffs.

The site selection team reviewed the results of the two sets of analyses. Where there were differences, the site selection team explored the reasons for those differences and came to a final conclusion regarding the preferred access road option. Where final recommendations were not possible, the remaining options were carried forward to the more detailed Phase 4A comparative evaluation of access road options.

The process for comparing the access route options was as follows:

- for each integrated and partially integrated option, access route options (where they exist) are briefly described. The options are also illustrated on a map;
- the issues associated with and the tradeoffs among the options are highlighted in summary tables;
- the analysis of these differences is presented in text form, where appropriate;
- preliminary recommendations regarding the preferred access route or routes are then made. Greater emphasis is given in the analysis to those factors ranked more highly;
- results of a quantitative cross-check of the options are presented;

- a final recommendation is put forward taking into account the differences in the rankings between the issues and tradeoffs analysis and the quantitative approach.

5.2.1.2 Scope and Level of Detail

Access road options are examined for: LF-3C, LF-9C, LF-1E, PI-1N, PI-1N to LF-2N, PI-13N, PI-13N to LF-2N, LF-4N, PI-27E and PI-27E to LF-1E. The following site selection consultants were involved in the preliminary Phase 4A analysis of access road options: M.M. Dillon-Transportation, Ecologistics Ltd., Gartner Lee Associates Ltd., Leon Kentridge Associates Ltd. and the Institute of Environmental Research Inc. Potential for risks and impacts are examined at this stage of analysis.

The site selection consultants employed basically the same factors as those employed in the Phase 3B evaluation of access road options. The agricultural and transportation analyses were enhanced by the addition or modification of factors. This level of detail is sufficient to identify the principle differences among the options for major potential risks and impacts. Where a clear preference is not evident and a more detailed analysis would be required to explore more subtle differences, the options are carried forward to the second step in the access road comparison.

The impacts along the 400 series highways are not examined. The analysis compares potential risks and impacts between the sites and the 400 series highways.

OWMC is committed to upgrading any local roads to its facilities to provincial standards.

5.2.1.3 Data Collection and Analysis

Generally, decisions were based on a re-examination of previously collected data and key tradeoffs associated with a particular access route option.

The data collection and analysis process included:

- a review of secondary source data (e.g. Official Plans);
- air photo interpretation for purposes of identifying and analyzing features (e.g. stream crossings);
- selective roadside field investigations;
- agency contacts (e.g. Ministry of Natural Resources, Ministry of Agriculture and Food).

The data were collected and synthesized in a number of ways, including:

- the use of models (transportation analysis);
- the preparation of maps;
- the incorporation of data inputs into matrices.

5.2.1.4 Facilities Characteristics Assumptions

The facilities characteristics assumptions employed in the preliminary Phase 4A access road analysis are listed in Table 5.2 together with an indication of their role in the analysis.

5.2.2 IDENTIFICATION OF FACTORS AND INDICATORS

The factors used by the other site selection consultants to compare the access road options are listed in Table 5.3. Table B.1 in Appendix B provides a rationale for each of the factors employed. Factors and indicators are applied to both regional and local access road options.

The agricultural analysis used the factor number of farm complexes with livestock instead of the livestock population factor employed in Phase 3B. The new factor provides more specific information on the location of livestock along the access roads. In addition, actual transportation accident frequencies are employed rather than the average accident frequencies used in Phase 3B. Some land use factors are screened because of an absence of data occurrence.

5.2.3 RANKING OF FACTORS

5:2.3.1 Introduction

The evaluation procedures employed by the other site selection consultants vary depending on the nature of the concerns under consideration. At a minimum, the consultants ranked their factors and the access road options. They also provided a rationale for their factor and option rankings. The scaling of data, based on the distribution of options under consideration, and the application of factor weights were additional evaluation steps that could be undertaken, where appropriate. Each consultant formulated and adopted an evaluation procedure most appropriate to the factors employed and the nature of the data base. In some cases, for example the hydrogeology analysis, there was only one factor. In such cases, access road options were simply ranked.

5.2.3.2 Ranking of Factors - Individual Consultants

The factors employed in the comparison of access road options are not equal in importance. The other site selection consultants therefore ranked their factors. Factors were ranked by the other site selection consultants based on the relative severity of risk to human health and potential environmental impacts.

Table B.2 in Appendix B indicates the ranking of factors of the other site selection consultants and the rationale for their rankings. Further details regarding the ranking of access road factors for the preliminary Phase 4A analysis of access road options are provided in the other consultants' Phase 4A technical reports.

TABLE 5.2

Facilities Characteristics Assumptions and Role in Analysis

FACILITIES CHARACTERISTICS ASSUMPTIONS	ROLE IN ANALYSIS
o the initial OWMC treatment facility would be sized for treating 150,000 t/a of incoming waste and provision would be made for future expansion to 300,000 t/a	o affects estimates of wastes to be transported o site selection employed the 300,000 t/a scenario
o trucking operations will be limited to regular (7 a.m. to 5 p.m.) daylight hours on a five day schedule (Monday to Friday) with no deliveries prior to 7 a.m. and no night deliveries (there will be minor exceptions to this)	o implications for social impact and agricultural analyses
o assume 180 vehicles per day each way in the movement of all waste, reagents and additives and process by-products[1]	o implications for social impact and agricultural analyses o used in transportation analysis
o all special waste can be assumed to arrive by road transport only, for purposes of site selection o shipment of bulk reagents and/or additives can be assumed to arrive by road or by rail	o implications for transportation analysis o rail haulage of special wastes to OWMC facility not examined

[1] Assumption used in second level of analysis or the Phase 4A analysis of access route options only

TABLE 5.2

Facilities Characteristics Assumptions and Role in Analysis

FACILITIES CHARACTERISTICS ASSUMPTIONS	ROLE IN ANALYSIS
o truck sizes assumed for delivery of special wastes to a site area: 18 tonne tanker trucks for pumpable waste, 24 tonne dump or lugger trucks for non-pumpables and 10 tonne flat bed or van body trucks for drummed waste[1]	o used in transportation analysis o implications for number of trucks employed
o vehicles to be used for hauling processed waste between non-integrated sites include: 30 tonne semi-trailer dump body for solidified waste, a 30 tonne semi-trailer tank body for landfill effluent and pretreated organics from physical/chemical plant, and 19-37 tonne trucks for additives and reagents depending upon commodities to be handled	o used in transportation analysis o implications for number of trucks employed

[1] Assumption used in second level of analysis or the Phase 4A analysis of access route options only

TABLE 5.3

Factors Used in Preliminary Phase 4A Analysis of Access Route Options

A. ACCESS ROADS - LOCAL

1. Human Environment

1.1 Transportation Safety
- proximity to arterial road
- number of level railway crossing on local roads and on total

1.2 Existing Residents
- number and size of population concentrations
- number of residences
- estimated population

1.3 Existing Agricultural Resources
- number of active farm complexes
- number of farm complexes with livestock
- length of access route

1.4 Existing Community and Recreation Features
- number and type of community and recreation features

1.5 Future Resources
- length across soil capability Class 1 equivalent agricultural land (km)

2. Physical and Biological Environment

2.1 Hydrogeology
- distance through hydrogeologically sensitive lands

2.2 Stream Crossings
- number and type of streams crossed and constraint rating

TABLE 5.3

Factors Used in Preliminary Phase 4A Analysis of Access Route Options

B. ACCESS ROADS - REGIONAL

1. Human Environment

1.1 Transportation Safety
- composite accident rate (accidents per million vehicles) (on local and regional roads)
- proximity to 400 series highway
- total number of level railway crossings (on local and regional roads)
- number of intersections where a turn is required (on local and regional roads)

1.2 Existing Residents
- distance through strip residential development (km)
- number and size of population concentrations
- estimated population

1.3 Existing Agricultural Resources
- number of active farm complexes
- number of farms complexes with livestock
- sensitive crops ($000s)
- length of access route

1.4 Existing Community and Recreation Feature
- number and type of community and recreation features

2. Physical and Biological Environment

2.1 Hydrogeology
- distance through hydrogeologically sensitive lands (m)

2.2 Stream Crossings
- number and type of streams crossed and constraint rating

5.2.3.3 Overall Ranking of Factors

It was necessary to compile an overall ranking of factors. A moderate land use constraint, for example, might not be equivalent to a moderate agricultural constraint. The identification and resolution of tradeoffs among factors is also essential to the identification of a preferred access route option.

The overall ranking of factors consisted of two steps:

i) screening of factors; and
ii) assignment of a rank to each factor.

i) Screening of Factors

Based upon a review of the data matrices and the evaluation procedures undertaken by the individual site selection consultants, certain factors could be dropped from the analysis. Table 5.4 indicates which factors were screened from the analysis and the screening rationale.

ii) Assignment of Factor Rank

Three factor rank levels 3, 2, 1 were employed in the overall ranking process. The factor rankings are based on general severity of potential risks or impacts, the significance of the resource potentially impacted and the potential for mitigation. Factors ranked 1 represent no or low potential risks or impacts with potential for mitigation. Factors ranked 2 represent moderate potential risks or impacts with some potential for mitigation. Factors ranked 3 have severe potential risks or impacts, and/or potentially severe impacts on sensitive features or resources and/or little potential for mitigation. Where possible, access road options possessing severe factor occurrences were avoided.

In some cases there are differences in potential impacts on the local access portion as compared with the regional access portion of access road options. The impact of OWMC traffic on existing residences and agricultural operations tends to be greater on local roads than on regional roads. OWMC generated traffic tends to represent a larger share of total traffic on local roads. However, because in most cases the local road component of the total access route is relatively small and the local roads are to be upgraded to provincial standards, the analysis considered the sum of the local and regional risks and impacts for each access route option. In cases where the differences between options were very small, the differences in impacts on residents and agricultural operations along the local access portions of the options was broken out and considered separately. Therefore, the factor length across Class 1 equivalent agricultural land was employed only if the access road options were considered basically equal from the standpoint of the other factors.

Since, in most cases, after the screening there was only one factor remaining in each factor grouping, access road options were ranked on the basis of factor groupings. The factor groupings were then referred to as factors. In the case of the factor grouping Transportation Safety the transportation consultant aggregated or combined factors in order to derive an overall ranking of access road options. Details regarding how the overall ranking of access road options from a transportation perspective was derived are found in Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Transportation (Dillon, 1985b).

In comparing the access road options, particular emphasis was given to minimizing potential risk to residents (in the event of an accidental release of contaminants) and to minimizing potential disruption to the use and enjoyment of properties as a result of increased truck noise and potential interference with property access and local traffic movements. Thus, wherever options were likely to have limited differences across all the factors, particular consideration was given to differences in potential impacts on residents.

TABLE 5.4

Factors Screened from Preliminary Phase 4A Analysis of Access Road Options

FACTOR SCREENED	RATIONALE FOR SCREENING
o proximity to arterial road (local access road)	o considered minor and indirect safety consideration; concern addressed through direct measure of sensitive features, e.g. number of residents
o proximity to 400 series highway (regional access road)	o considered minor and indirect safety measure; concern addressed through direct measures of sensitive features, e.g. number of residents o considered double counting since indirectly reflected in composite accident rates
o number and size of population concentrations (local and regional access roads)	o represents double counting o population concentrations were used only where there were significant differences between options not evident through the application of other factors
o number of residences (local access roads)	o double counting - estimated population along access roads (local and regional access roads) employed in analysis
o distance through strip residential development (regional access roads)	o population concentrations used only where there were significant differences between options not evident through application of other factors, e.g. number of residents
o number of farm complexes with livestock (local and regional access roads)	o represents double counting o number of farm complexes with livestock also included in number of active farm complexes; finer distinctions not required for comparative evaluation purposes
o length of access route (local and regional access roads)	o represents double counting o minor and indirect measure of potential impact; already addressed more directly by other factors

The overall ranking of factors used in the preliminary Phase 4A analysis of access road options and a rationale for the ranking are provided in Table 5.5.

5.2.4 APPLICATION OF FACTORS - PRELIMINARY COMPARATIVE EVALUATION

Integrated Siting Options

(a) LF-3C

Six access route options remained for the fully integrated siting option LF-3C. These options are illustrated on Figure 5.2 and include the following:

1. from QEW - south on Vineland Townline Road (Regional Road 24); west on Highway 20; south on Regional Road 27; west on Elcho Road to LF-3C (preferred Phase 3 Report).

2. from QEW - south on Regional Road 18 (Beamsville Road); west on Regional Road 69 (Twenty Mile Road); south on Regional Road 569; south on Highway 20; south on Regional Road 27; west on Elcho Road to LF-3C.

3. from QEW - south on Regional Road 14; south on Regional Road 714; east on Regional Road 73; south on Regional Road 14; south on Regional Road 16 to LF-3C.

4. from QEW - south on Regional Road 18; west on Regional Road 69; south on Highway 20; south on Regional Road 27; west on Elcho Road to LF-3C.

TABLE 5.5

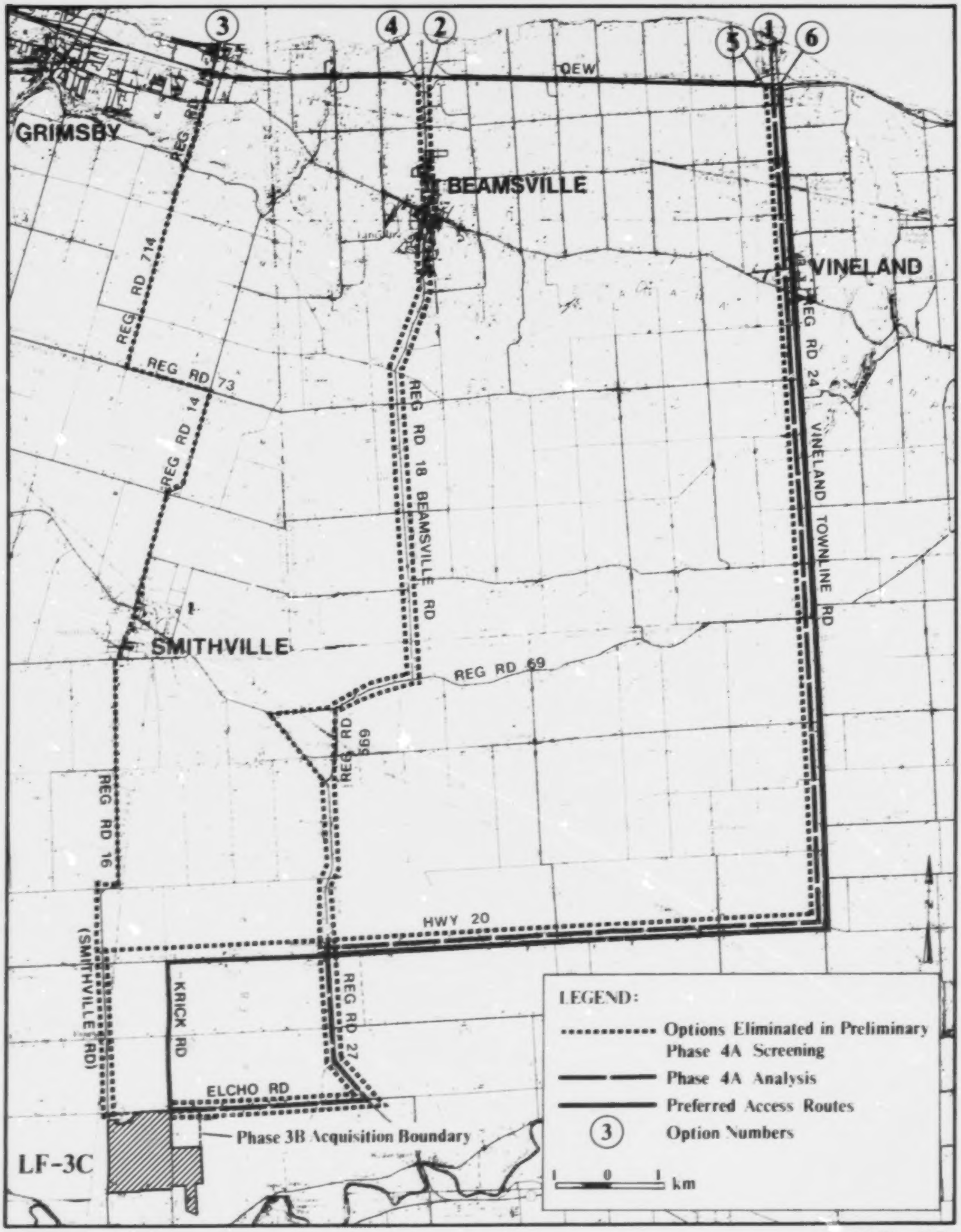
Overall Ranking of Factors

FACTOR RANK	FACTOR	RATIONALE FOR FACTOR RANK
3	o Transportation Safety	o transportation safety addresses the potential of transportation accidents associated with the transport of special wastes and additives and reagents o potential of an accident is dependent upon the existing characteristics of the access road option
3	o Existing Residents	o the major day-to-day concerns associated with access routes is the potential disturbance to the use and enjoyment of property as a result of truck noise, exhaust fumes and potential interference with property access and local traffic movements. A particular effort was, therefore, made to minimizing the distance through residential areas. In the remote event of an accidental release, human exposure could represent a potential concern. Emphasis was therefore placed upon access route selection that would minimize population exposure.
3	o Existing Agricultural Resources and Future Resources	o agriculture was considered an important concern in terms of potential interference with farm vehicle movements and potential effects on farm operations o desirable to minimize impact on agricultural resources

TABLE 5.5

Overall Ranking of Factors

FACTOR RANK	FACTOR	RATIONALE FOR FACTOR RANK
2	o Existing Community and Recreation Features	o lower importance attached to features than residents, few major features and features tend to be set somewhat further back; major day-to-day concerns associated with access routes would be potential disturbance to the use and enjoyment of public and private features. An attempt was, therefore, made to minimize the distance through areas with a large number of community features.
2	o Stream Crossings	o potential biological impacts, as represented by the number and significance of stream crossings, were somewhat less important route comparison consideration. The accidental release of contaminants into a watercourse could represent a serious concern. At the same time the likelihood of an accidental spill in transit is very remote and the likelihood that such a spill would involve a direct release into a major watercourse is even more remote. Even in the event of an accidental release, there is the potential for remedial action prior to environmental damage.
1	o Hydrogeology	o hydrogeologic impacts as represented by distance through hydrogeologically sensitive lands was considered a relatively minor risk-related consideration. This ranking took into account the likelihood that remedial clean-up actions would be taken within hours of an accidental spill and that they would generally be sufficient to contain contaminants.


③
④
②
⑤
①
⑥
QEW
GRIMSBY
BEAMSVILLE
VINELAND
SMITHVILLE
REG RD 714
REG RD 73
REG RD 14
REG RD 18 BEAMSVILLE RD
REG RD 24 VINELAND TOWNLINE RD
REG RD 69
REG RD 569
REG RD 16 (SMITHVILLE RD)
HWY 20
KRICK RD
REG RD 27
ELCHO RD
Phase 3B Acquisition Boundary
LF-3C
LEGEND:
Options Eliminated in Preliminary Phase 4A Screening
Phase 4A Analysis
Preferred Access Routes
③ Option Numbers
1 0 1 km

LF-3C

PHASE 4A ACCESS ROADS

FIGURE 5.2

5. from QEW - south on Vineland Townline Road (Regional Road 24); west on Highway 20; west on Regional Road 65 from Bismarck; south on Smithville Road to LF-3C.

6. from QEW - south on Vineland Townline Road (Regional Road 24); west on Highway 20; west on Regional Road 65 from Bismarck; south on Krick Road to LF-3C.

The access routes involve access from the QEW using either Regional Road 24, Regional Road 18 or Regional Road 14. The consultants' ranking of these access road options are presented in Table B.3 in Appendix B.

A summary of the major issues pertaining to access road options to LF-3C is provided in Table 5.6. The ranking of access road options and a rationale for the ranking is provided in Table 5.7.

Based on a review of the major issues associated with each access road option, the options are ranked from most preferred to least preferred as follows: Options 6, 1, 2, 3, 4 and 5. Options 1 and 6 pass through the Town of Vineland which has a substantially lower population than Beamsville or Grimsby. Options 1 and 6 also avoids two level railway crossings associated with each of Options 2, 3, 4 and 5. In addition, Options 1 and 6 have lower composite accident rates than the other access route options. Although agricultural impacts were potentially less for Options 2 and 3 the minimization of risk and impact on residents along the access road and in communities through which the access road passes should be given higher priority.

Table B.4 in Appendix B provides the results of the quantitative analysis. The results indicate that Options 2, 3 and 4 are preferred over Option 1. This result is contrary to the ranking derived from the examination of major issues.

TABLE 5.6

Summary of Major Issues - Access Roads - LF-3C

FACTOR / OPTION	OPTION 1	OPTION 2	OPTION 3	OPTION 4	OPTION 5	OPTION 6
EXISTING COMMUNITY & RECREATION FEATURES	° 11 features	° 8 features	° 10 features	° 11 features	° 10 features	° 11 features
EXISTING RESIDENTS	° 516 people along access route ° passes through Vineland (1,150 pop.)	° 400 people along access route ° passes through Beamsville (5,000 pop.)	° 234 people along access route ° passes through Grimsby (16,007 pop.)	° 614 people along access route ° passes Vineland (1150 pop.)	° 544 people along access route ° passes through Vineland (1,150 pop.)	° 569 people along access route ° passes through Vineland (1,150 pop.)
TRANSPORTATION SAFETY	° 51.84 accidents per million vehicles ° 0 level railway crossings	° 56.26 accidents per million vehicles ° 2 level railway crossings	° 67.87 accidents per million vehicles ° 2 level railway crossings	° 60.66 accidents per million vehicles ° 2 level railway crossings	° 55.88 accidents per million vehicles ° 2 level railway crossings	° 46.79 accidents per million vehicles ° 0 level railway crossings
EXISTING AGRICULTURAL RESOURCES	° 55 active farm complexes ° sensitive crop value - $2,007	° 47 active farm complexes ° sensitive crop value - $2,060	° 40 active farm complexes ° sensitive crop value - $672	° 50 active farm complexes ° sensitive crop value $2,107	° 56 active farm complexes ° sensitive crop value $2,257	° 47 active farm complexes ° sensitive crop value $2,095
STREAM CROSSINGS	° total 27 stream crossings ° crossing of Twenty Mile Creek	° total 15 stream crossings	° total 15 stream crossings	° total 15 stream crossings	° total 31 stream crossings ° major constraint	° total 31 stream crossings ° major constraint
HYDROGEOLOGY	° 4,400 m sensitive lands crossed	° 2,300 m sensitive lands crossed	° 3,050 m sensitive lands crossed	° 2,350 m sensitive lands crossed	° 4450 m sensitive lands crossed	° 4300 m sensitive lands crossed

TABLE 5.7

Overall Ranking of Preliminary Phase 4A Access Road Options

LF-3C

OPTION	RANKING	RATIONALE FOR RANKING
1	2	o passes through less populated areas than Beamsville or Grimsby o large number of active farm complexes o low composite accident rate o no level railway crossings
2	3	o passes through Beamsville (5,000 population) o involves 2 level railway crossings o few community and recreation features
3	4	o passes through Grimsby (16,007 population) o involves 2 level railway crossings o few active farm complexes o low sensitive crop value
4	5	o passes through Beamsville (5,000 population) o involves 2 level railway crossings o high composite accident rate o large number of active farm complexes
5	6	o passes through Vineland (1,150 population) o involves 2 level railway crossings o large number of active farm complexes o high sensitive crop value
6	1	o passes through less populated areas than Grimsby or Beamsville o low composite accident rate o large number of active farm complexes o no level railway crossings

Despite the variation in ranking derived from the quantitative analysis, Options 1 and 6 should be retained for further analysis in Phase 4A. The major difference among the options is the size of communities through the routes pass. Options 2 and 4 pass through Beamsville and Option 3 passes through Grimsby. This difference is sufficient to maintain the preference for Option 1. The differences between Options 1 and 6 are not significant at the preliminary Phase 4A level of detail.

The local access options of Elcho Road (Option 1) and Krick Road (Option 6) should be examined further in Phase 4A.

(b) LF-9C

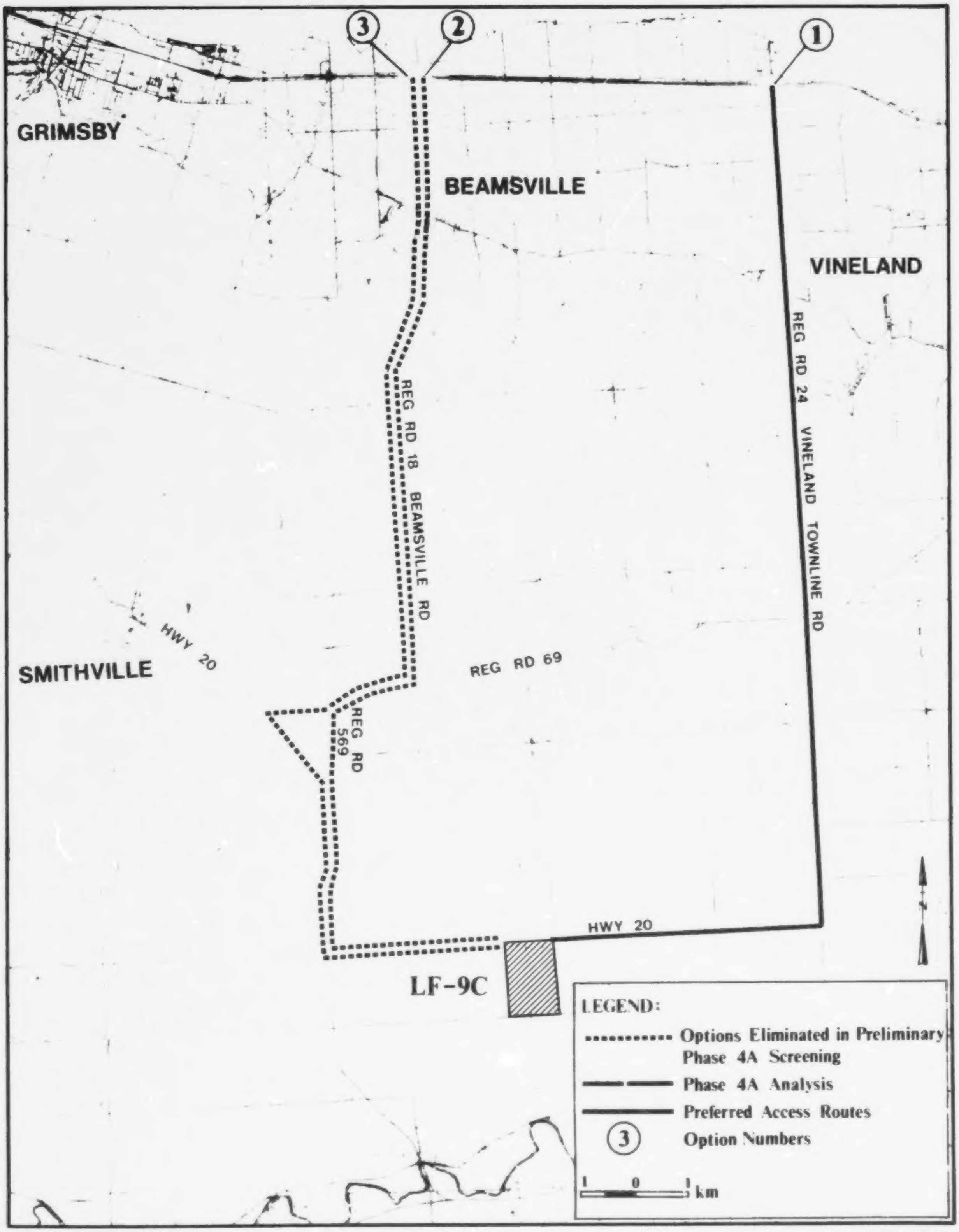
Three access route options remained for the fully integrated siting option LF-9C. These options are illustrated on Figure 5.3 and include the following:

1. from QEW - south on Vineland Townline Road (Regional Road 24); west on Hwy. 20 to LF-9C (preferred - Phase 3 Report).

2. from QEW - south on Regional Road 18; west on Regional Road 69; south on Regional Road 569; south on Highway 20; east on Highway 20 to LF-9C.

3. from QEW - south on Regional Road 18; west on Regional Road 69; south on Highway 20; east on Highway 20 to LF-9C.

The access routes involve access from the QEW using either Regional Road 24 or Regional Road 18. The consultants' rankings of these access road options are presented in Table B.5.


③
②
①
GRIMSBY
BEAMSVILLE
VINELAND
REG RD 24 VINELAND TOWNLINE RD
REG RD 18 BEAMSVILLE RD
HWY 20
SMITHVILLE
REG RD 69
REG RD 569
HWY 20
LF-9C
LEGEND:
Options Eliminated in Preliminary Phase 4A Screening
Phase 4A Analysis
Preferred Access Routes
③ Option Numbers
1 0 1 km

LF-9C

PHASE 4A ACCESS ROADS

FIGURE 5.3

A summary of the major issues pertaining to access road options to LF-9C is provided in Table 5.8. The ranking of access road options and a rationale for the ranking is provided in Table 5.9.

Based on a review of the major issues associated with each access road option, Option 1 is preferred. Option 3 is the least preferred. There are substantially more people living along Options 2 and 3 than Option 1. Options 2 and 3 also pass through Beamsville and are much less desirable from transportation safety and agricultural perspectives. Options 2 and 3 have a much higher accident rate than Option 1. Both options have a large number of intersections where a turn is required. Options 2 and 3 also have substantially more farm complexes than Option 1.

Table B.6 in Appendix B provides the results of the quantitative analysis. The results of the quantitative analysis are consistent with the rankings derived from the issues analysis.

On the basis of the above Option 1 should be retained and carried forward to the detailed comparative evaluation of siting options. Options 2 and 3 should be eliminated from further consideration in Phase 4A.

(c) LF-1E

Five access route options remained for the fully integrated siting option LF-1E. These options are illustrated on Figure 5.4 and include the following:

1. from QEW - west on Regional Road 47 (Lyons Creek Road/Biggar Road); south on Regional Road 98 (Montrose Road); west on Carl Road to LF-1E (preferred - Phase 3 Report).

TABLE 5.8

Summary of Major Issues - Access Roads - LF-9C

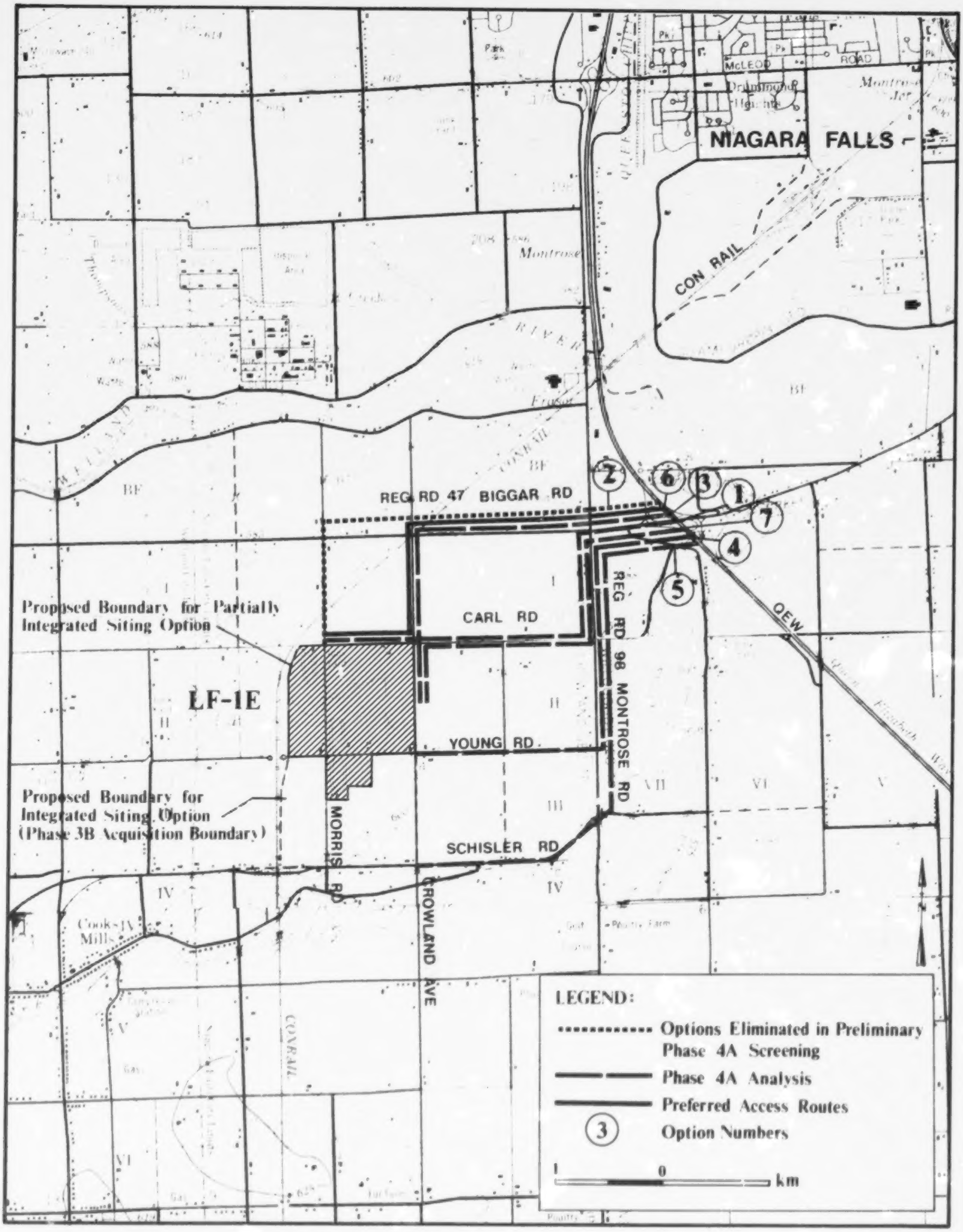
OPTION FACTOR	OPTION 1	OPTION 2	OPTION 3
EXISTING COMMUNITY & RECREATION FEATURES	° 9 features	° 11 features	° 11 features
EXISTING RESIDENTS	° 271 people along access route ° passes through Vineland (1,150 pop.)	° 407 people along access route ° passes through Beamsville (5,000 pop.) St. Anns (75 pop.) Bismarck (50 pop.)	° 601 people along access route ° passes through Beamsville (5,000 pop.) and Bismarck (50 pop.)
TRANSPORTATION SAFETY	° 35.66 accidents per million vehicles ° only 1 intersection where turn required	° 52.12 accidents per million vehicles ° 6 intersections where turn required	° 56.60 accidents per million vehicles ° 5 intersections where turn required
EXISTING AGRICULTURAL RESOURCES	° 22 active farm complexes ° sensitive crop value - $1,813	° 42 active farm complexes ° sensitive crop value - $2,078	° 47 active farm complexes ° sensitive crop value - $2,124
STREAM CROSSINGS	° total 18 stream crossings ° major constraint	° total 11 stream crossings ° moderate constraint	° total 11 stream crossings ° moderate constraint
HYDROGEOLOGY	° 4,300 m sensitive lands crossed	° 2,200 m sensitive lands crossed	° 2,250 m sensitive lands crossed

TABLE 5.9

Overall Ranking of Preliminary Phase 4A Access Road Options

LF-9C

OPTION	RANKING	RATIONALE FOR RANKING
1	1	o fewest number of community and recreation features o fewest number of people along access route o lowest composite accident rate o lowest number of active farm complexes and lowest sensitive crop value
2	2	o Options 2 and 3 pass through Beamsville - greater number of people along access route o higher accident rate from Option 1
3	3	o highest number of people along access route o highest composite accident rate o highest number of active farm complexes and highest sensitive crop value


McLEOD
ROAD
Drummond Heights
Montrose Jct
NIAGARA FALLS
CON RAIL
Montrose
RIVER
WELLAND
Fraser
CONRAIL
BF
BF
BF
2
6
3
1
7
4
5
REG RD 47 BIGGAR RD
CARL RD
REG RD 98 MONTROSE RD
OEW
Queen Elizabeth Way
I
I
II
II
III
IV
IV
V
VI
VI
VII
Proposed Boundary for Partially Integrated Siting Option
LF-1E
YOUNG RD
Proposed Boundary for Integrated Siting Option (Phase 3B Acquisition Boundary)
MORRIS RD
SCHISLER RD
CROWLAND AVE
Cooks Mills
LEGEND:
Options Eliminated in Preliminary Phase 4A Screening
Phase 4A Analysis
Preferred Access Routes
3 Option Numbers
1
0
km

LF-1E

PHASE 4A ACCESS ROADS

FIGURE 5.4

2. from QEW - west on Regional Road 47 (Lyons Creek Road/Biggar Road);
   south on Morris Road to LF-1E.

3. from QEW - west on Regional Road 47 (Lyons Creek Road/Biggar Road);
   south on Crowland Road to LF-1E.

4. from QEW - west on Regional Road 47 (Lyons Creek Road/Biggar Road);
   south on Montrose Road; west on Young Road to LF-1E.

5. from QEW - west on Regional Road 47 (Lyons Creek Road/Biggar Road);
   south on Montrose Road; west on Schisler Road (Regional Road 27) to LF-1E.

The access routes involve access from the QEW using Regional Road 47 (Lyons Creek Road/Biggar Road) and various local access options. The consultants' rankings of these access road options are presented in Table B.7 in Appendix B.

A summary of the major issues pertaining to access road options to LF-1E is provided in Table 5.10.

Based on a review of the major issues associated with each access road option, the differences among the options are slight. In particular, the differences between Options 1, 3, 4 and 5 are minimal. The selection of a final access road to this siting option is dependent upon the final refinement of the site boundaries. An overall ranking of access road options was, therefore, not derived.

Option 2 should, however, be eliminated from further consideration in Phase 4A because of two level railway crossings which pose a risk from a transportation safety perspective.

TABLE 5.10

Summary of Major Issues - Access Roads - LF-1E

OPTION FACTOR	OPTION 1	OPTION 2	OPTION 3	OPTION 4	OPTION 5
EXISTING COMMUNITY & RECREATION FEATURES	° 1 feature	° 0 features	° 0 features	° 1 features	° 4 features
EXISTING RESIDENTS	° 35 people along access route	° 42 people along access route	° 28 people along access route	° 34 people along access route	° 65 people along access route
TRANSPORTATION SAFETY	° 7.95 accidents per million vehicles	° 5.78 accidents per million vehicles ° two level railway crossings	° 6.35 accidents per million vehicles ° one level railway crossing	° 7.56 accidents per million vehicles	° 11.57 accidents per million vehicles
EXISTING AGRICULTURAL RESOURCES	° 2 active farm complexes ° sensitive crop value - $133	° 3 active farm complexes ° sensitive crop value - $34.5	° 2 active farm complexes ° sensitive crop value - $20.5	° 1 active farm complex ° sensitive crop value - $25.0	° 1 active farm complex ° sensitive crop value - $60.4
STREAM CROSSINGS	° total 2 stream crossings ° no constraint	° 0 stream crossings	° 0 stream crossings	° total 3 stream crossings ° no constraint	° total 4 stream crossings ° minor constraint
HYDROGEOLOGY	° 150 m sensitive lands crossed	° 0 m sensitive lands crossed	° 0 m sensitive lands crossed	° 150 m sensitive lands crossed	° 1200 m sensitive lands crossed

Table B.8 in Appendix B provides the results of the quantitative analysis. The analysis provided a ranking of access road options from most to least preferred as follows: Options 4, 1, 3, 2 and 5. The low ranking for Option 2 with the quantitative analysis is inconsistent with the conclusion that Option 2 should be excluded.

On the basis of the above, Options 1, 3, 4 and 5 should be retained and examined further in Phase 4A. Option 2 should be eliminated from further consideration.

Partially Integrated Options - Introduction

The comparison of partially integrated access route options is more complex than the comparison of access route options for fully integrated facilities. In the case of partially integrated facilities it is necessary to evaluate three sets of options as follows:

- access to the PI site;
- access to the LF site from the PI site;
- access to the LF site (in the event that a physical/chemical treatment plant is located at the landfill).

The differences among these sets of options are highlighted in the following subsections.

(d) LF-2N/PI-IN[1]

The preferred access routes for LF-2N and for PI-1N from the south were identified in Phase 3B.

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[1] Siting options that included LF-2N were a part of the Phase 4A access road evaluation. However, in May, 1985, OWMC dropped LF-2N from further consideration. The rationale for the dropping of LF-2N is summarized in Chapter 8 of this volume.

(i) to PI-1N - From the North

For access from the north to PI-1N the following options remained:

1. from 401 - south on Fourth Line; west on Britannia Road to PI-1N (preferred - Phase 3 Report).

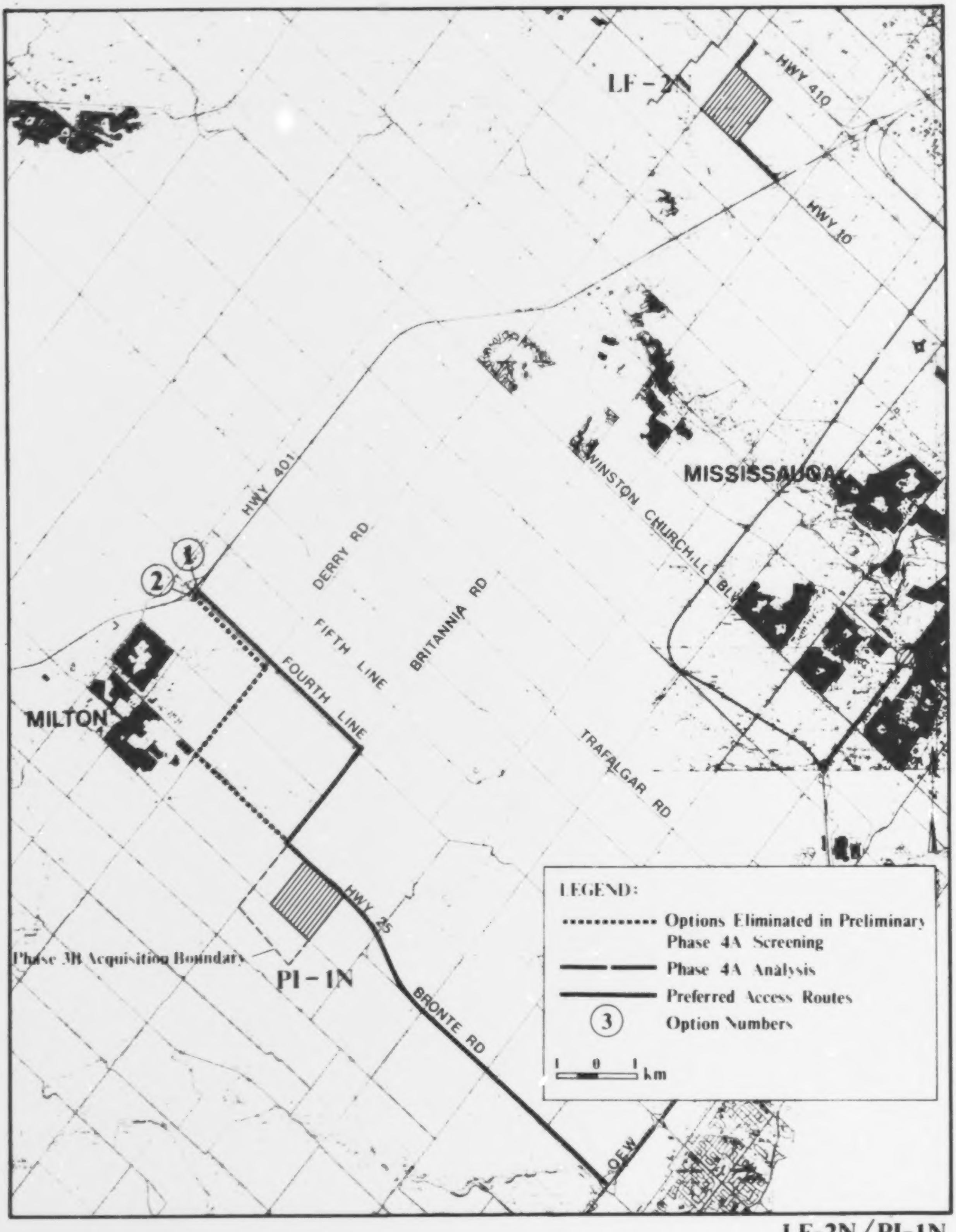
2. from 401 - south on Fourth Line Road; west on Derry Road; south on Highway 25 to PI-1N.

These options are illustrated on Figure 5.5. Option 1 was the preferred access route in the OWMC Phase 3 Report. Option 2 was identified in the early stages of Phase 4A. The consultants' rankings of these access road options are presented in Table B.9 in Appendix B.

A summary of the major issues pertaining to the access road options to PI-1N is provided in Table 5.11. The ranking of the access road options and a rationale for the ranking is provided in Table 5.12.

Based on a review of the major issues associated with each access road option, Option 1 was preferred over Option 2. The major difference between the two options is that Option 2 passes through a portion of the built-up area of Milton.

Table B.10 in Appendix B provides the results of the quantitative analysis. The results of the quantitative analysis indicate that Option 2 is preferred over Option 1. The concern with an access road passing through a portion of Milton is sufficient reason to maintain the preference for Option 1. Option 1 should, therefore, be retained and carried forward to the detailed comparative evaluation.


LF-2N
HWY 410
HWY 10
MISSISSAUGA
WINSTON CHURCHILL BLVD
HWY 401
1
2
DERRY RD
BRITANNIA RD
FIFTH LINE
FOURTH LINE
MILTON
TRAFALGAR RD
HWY 25
Phase 3B Acquisition Boundary
PI-1N
BRONTE RD
QEW
LEGEND:
Options Eliminated in Preliminary Phase 4A Screening
Phase 4A Analysis
Preferred Access Routes
3 Option Numbers
1 0 1 km

LF-2N/PI-1N
TO PI-1N
PHASE 4A ACCESS ROADS
FIGURE 5.5

TABLE 5.11

Summary of Major Issues - Access Roads - PI-1N

OPTION FACTOR	OPTION 1	OPTION 2
EXISTING COMMUNITY & RECREATION FEATURES	° 4 features	° 1 feature
EXISTING RESIDENTS	° 135 people along access route ° passes through Omagh (30 pop.) and Boyne (<25 pop.)	° 295 people along access route ° passes through Milton (29,591 pop.) and Boyne (<25 pop.)
TRANSPORTATION SAFETY	° 15.74 accidents per million vehicles	° 9.93 accidents per million vehicles
EXISTING AGRICULTURAL RESOURCES	° 13 active farm complexes ° sensitive crop value $94	° 11 active farm complexes ° sensitive crop value - $125.9 ° avoids a more actively used area for agriculture
STREAM CROSSINGS	° total 8 stream crossings	° total 7 stream crossings
HYDROGEOLOGY	° 250 m sensitive lands crossed	° 1400 m sensitive lands crossed

TABLE 5.12

Overall Ranking of Preliminary Phase 4A Access Road Options

PI-1N

OPTION	RANKING	RATIONALE FOR RANKING
1	1	o passes through smaller population concentrations - Omagh (30 pop.) and Boyne (< 25 pop.) o lower sensitive crop value o less length through hydrogeologically sensitive lands
2	2	o passes through Milton (29,591 pop.) and Boyne (< 25 pop.) o higher sensitive crop value

(ii) PI-1N to LF-2N

Two access route options remained for intersite transfers from PI-1N to LF-2N. These options are shown on Figure 5.6 and include the following:

1. east on Britannia Road; north on Fourth Line Road; east on Highway 401; north on Highway 10 to LF-2N (preferred - Phase 3 Report).

2. west on Britannia Road; north on Tremaine Road; east on Steeles Avenue; north on Highway 25; east on Highway 401; north on Highway 10 to LF-2N.

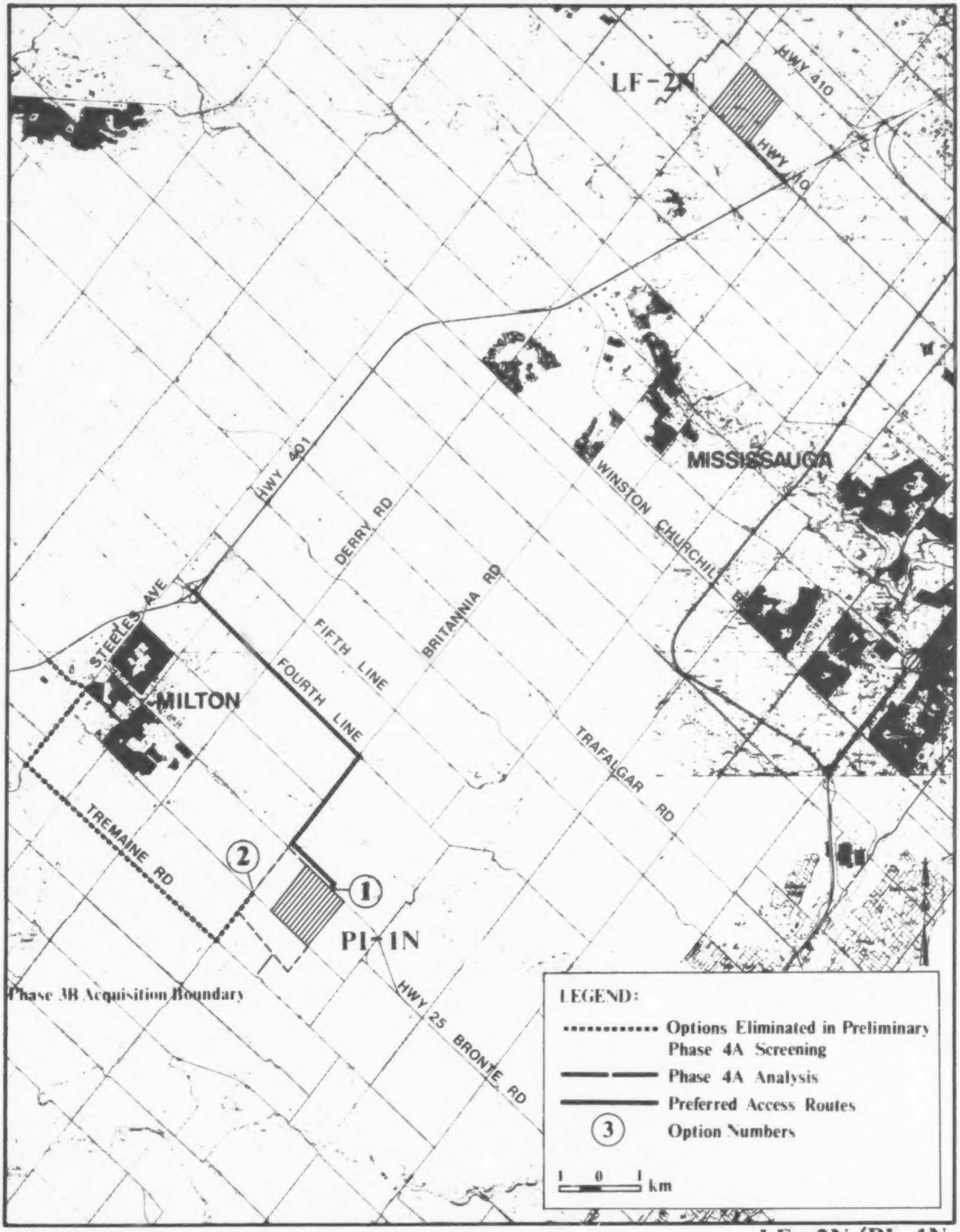
The consultants' rankings of these access road options are presented in Table B.11 in Appendix B.

A summary of the major issues pertaining to the intersite transfer routes between PI-1N and LF-2N is provided in Table 5.13. The ranking of these access road options and a rationale for the ranking is provided in Table 5.14.

Based on a review of the major issues associated with each access road option, Option 1 is preferred over Option 2. The major reasons contributing to the preference for Option 1 are the far fewer residents and the lower accident rates associated with Option 1.

Table B.12 in Appendix B provides the results of the quantitative analysis. The factor scores derived for each of the options are equal.

Option 1 should be retained and carried forward to the detailed comparative evaluation of siting options. Option 2 should be eliminated from further consideration.


LF-2N
HWY 410
HWY 410
HWY 401
MISSISSAUGA
WINSTON CHURCHILL BLVD
DERRY RD
BRITANNIA RD
FIFTH LINE
FOURTH LINE
STEELES AVE
MILTON
TRAFALGAR RD
TREMAINE RD
②
①
PI-1N
HWY 25 BRONTE RD
Phase 3B Acquisition Boundary
LEGEND:
Options Eliminated in Preliminary Phase 4A Screening
Phase 4A Analysis
Preferred Access Routes
③ Option Numbers
1 0 1 km

LF-2N/PI-1N
PI-1N TO LF-2N
PHASE 4A ACCESS ROADS
FIGURE 5.6

TABLE 5.13

Summary of Major Issues - Access Roads - PI-1N to LF-2N

OPTION FACTOR	OPTION 1	OPTION 2
EXISTING COMMUNITY & RECREATION FEATURES	° 5 features	° 7 features
EXISTING RESIDENTS	° 263 people along access route ° passes through Omagh (30 pop.), Boyne (< 25 pop.) and Derry West (110 pop.)	° 207 people along access route ° passes through Milton (29,591 pop.) and Derry West (110 pop.)
TRANSPORTATION SAFETY	° 18.59 accidents per million vehicles	° 46.24 accidents per million vehicles
EXISTING AGRICULTURAL RESOURCES	° 16 active farm complexes ° sensitive crop value $101	° 13 active farm complexes ° sensitive crop value $131
STREAM CROSSINGS	° total 13 stream crossings ° involves crossing of Sixteen Mile	° total 17 stream crossings
HYDROGEOLOGY	° 250 m sensitive lands crossed	° 350 m sensitive lands crossed

TABLE 5.14

Overall Ranking of Preliminary Phase 4A Access Road Options

PI-1N to LF-2N

OPTION	RANKING	RATIONALE FOR RANKING
1	1	o lower composite accident rate o lower sensitive crop value o less land through hydrogeologically sensitive lands
2	2	o passes through Milton (29,591 pop.) and Derry West (110 pop.)

(e) LF-2N/PI-13N

The preferred access routes for LF-2N and for PI-13N from the south were identified in Phase 3B.

(i) PI-13N - From the North

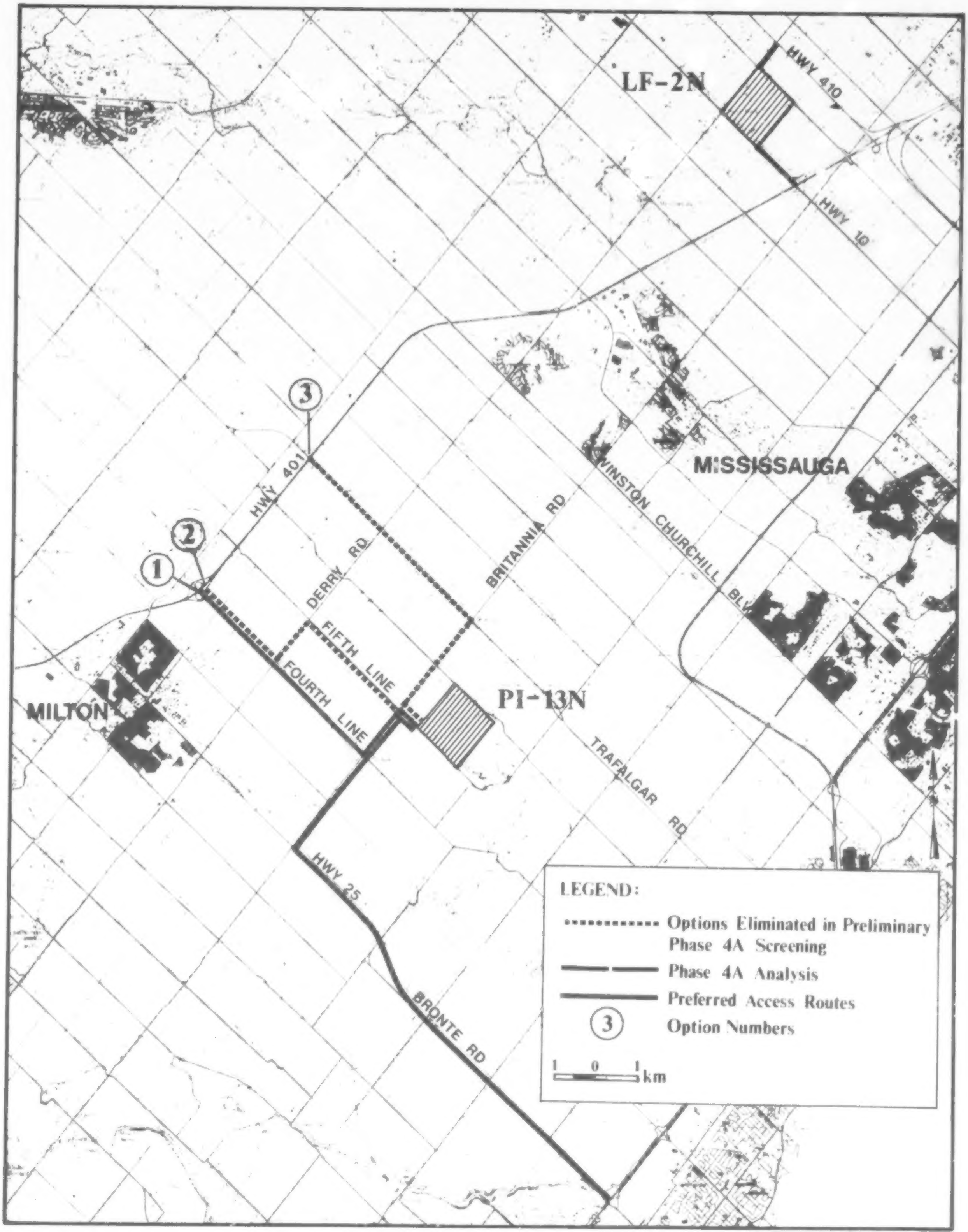
For access from the north to PI-13N, the following options remained:

1. from 401 - south on Fourth Line Road; east on Britannia Road; south on Fifth Line Road to PI-13N (preferred - Phase 3 Report).
2. from 401 - south on Fourth Line Road; east on Derry Road; south on Fifth Line to PI-13N.
3. from 401 - south on Trafalgar Road; west on Britannia Road; south on Fifth Line Road to PI-13N.

These options are illustrated on Figure 5.7. The consultants' rankings of these access road options are presented in Table B.13 in Appendix B.

A summary of the major issues pertaining to access road options to PI-13N is provided in Table 5.15. The ranking of the access road options and a rationale for the ranking is provided in Table 5.16.

The differences among the options are limited. Options 1 and 2 have the fewest number of people along the access road. Option 1 has a slightly higher composite accident rate than Option 2. Option 3 has the largest number of people along the access road and the largest number of active farm complexes, stream crossings and length of hydrogeologically sensitive lands crossed. Option 1 has the lowest sensitive crop value.


LF-2N
HWY 410
HWY 10
MISSISSAUGA
3
HWY 401
2
1
DERRY RD
BRITANNIA RD
WINSTON CHURCHILL BLV
FIFTH LINE
FOURTH LINE
MILTON
PI-13N
TRAFALGAR RD
HWY 25
BRONTE RD
LEGEND:
Options Eliminated in Preliminary Phase 4A Screening
Phase 4A Analysis
Preferred Access Routes
3 Option Numbers
1 0 1 km

LF-2N/PI-13N
TO PI-13N
PHASE 4A ACCESS ROADS
FIGURE 5.7

TABLE 5.15

Summary of Major Issues - Access Roads - PI-13N

OPTION FACTOR	OPTION 1	OPTION 2	OPTION 3
EXISTING COMMUNITY & RECREATION FEATURES	° 1 feature	° 1 feature	° 5 features
EXISTING RESIDENTS	° 56 people along access route	° 110 people along access route	° 177 people along access route
TRANSPORTATION SAFETY	° 13.93 accidents per million vehicles	° 11.12 accidents per million vehicles	° 12.62 accidents per million vehicles
EXISTING AGRICULTURAL RESOURCES	° 15 active farm complexes ° sensitive crop value $69.3	° 7 active farm complexes ° sensitive crop value $74.2	° 18 active farm complexes ° sensitive crop value $170.9
STREAM CROSSINGS	° total 7 stream crossings ° involves crossing of Sixteen Mile Creek ° major constraint	° total 7 stream crossings ° minor constraint	° total 10 stream crossings ° involves crossing of Sixteen Mile Creek ° major constraint
HYDROGEOLOGY	° 0 m sensitive lands crossed	° 200 m sensitive lands crossed	° 5,600 m sensitive lands crossed

TABLE 5.16

Overall Ranking of Preliminary Phase 4A Access Road Options

PI-13N

OPTION	RANKING	RATIONALE FOR RANKING
1	1	o few people along access route o only one community and recreation feature adjacent to access route o low sensitive crop value o no hydrogeologically sensitive lands crossed
2	2	o few people along access route o lowest composite accident rate o fewest active farm complexes o 200 m hydrogeologically sensitive lands crossed
3	2	o low composite accident rate o 5,600 m hydrogeologically sensitive lands crossed

Based on a review of the major issues associated with each access road option, Option 1 is the preferred option. Options 2 and 3 are ranked equally as the least preferred options.

Table B.14 in Appendix B provides the results of the quantitative analysis. The results of the quantitative analysis indicate a preference for Option 2 as the preferred access road option followed by Options 1 and 3 as the least preferred options.

Option 1 should be retained and carried forward to the detailed comparative evaluation. The main reasons for this conclusion include:

- Option 1 has far fewer people living along the access route;
- Option 1 has only one community and recreation feature;
- Option 1 has a much lower sensitive crop value;
- Option 1 crosses no hydrogeologically sensitive lands;
- the differences among the options with respect to transportation safety are quite limited.

The entire Fourth Line - Fifth Line corridor should, however, be analysed further in Phase 4B, if one of the PI-13N siting options is selected as the preferred siting option. The possibilities of connecting Fourth Line to the James Snow Parkway and/or upgrading and shifting the access road by one-half concession should also receive further consideration in Phase 4B.

(ii) PI-13N to LF-2N

Four access options remained for intersite transfers between PI-13N and LF-2N. These options are illustrated on Figure 5.8 and include:

1. north on Fifth Line Road; east on Britannia Road; north on Trafalgar Road (Regional Road 3); east on Highway 401; north on Highway 10 to LF-2N.

2. north on Fifth Line Road; west on Britannia Road; north on Fourth Line Road; east on Highway 401; north on Highway 10 to LF-2N (preferred - Phase 3 Report).

3. north on Fifth Line Road; west on Derry Road; north on Fourth Line Road; east on Highway 401; north on Highway 10 to LF-2N.

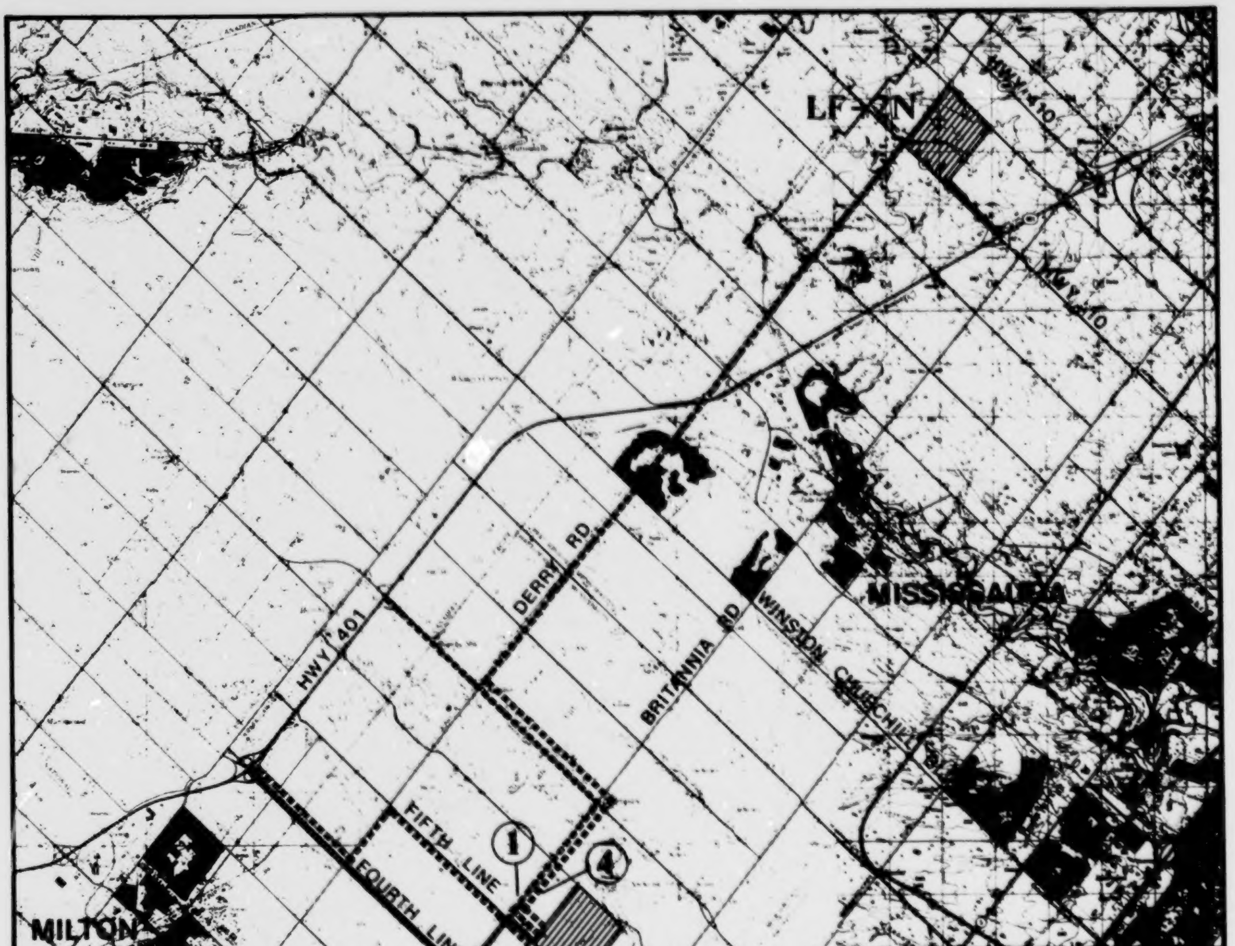
4. north on Fifth Line Road; east on Britannia Road; north on Trafalgar Road; east on Derry Road to LF-2N.

The consultants' ranking of these access road options are presented in Table B.15 in Appendix B.

A summary of the major issues pertaining to the intersite transfer routes between PI-13N and LF-2N is provided in Table 5.17. The ranking of access road options and a rationale for the ranking is provided in Table 5.18.

Based on a review of the major issues associated with each access road option, Option 2 is the most preferred. Option 4 is the least preferred. Options 3 and 1 are ranked as second and third most preferred, respectively. There is a clear difference between Options 1, 2 and 3 and Option 4. Option 4 has a substantially greater population along the access route, a large number of community and recreation features, a large number of active farm complexes and a significantly higher composite accident rate.

Option 3 is slightly preferred over Option 1 because of fewer residents and features along the access route, a lower composite accident rate and fewer active farm complexes.


LF-2N
HWY 410
HWY 410
DERRY RD
MISSISSAUGA
HWY 401
BRITANNIA RD
WINSTON CHURCHILL BLVD
FIFTH LINE
FOURTH LINE
1
4
MILTON
3
2
PI-13N
TRAFALGAR RD
HWY 25 BRONTE RD
LEGEND:
Options Eliminated in Preliminary Phase 4A Screening
Phase 4A Analysis
Preferred Access Routes
3
Option Numbers
1 0 1 km

LF-2N/ PI-13N
PI-13N TO LF-2N
PHASE 4A ACCESS ROADS
FIGURE 5.8

TABLE 5.17

Summary of Major Issues - Access Roads - PI-13N to LF-2N

OPTION FACTOR	OPTION 1	OPTION 2	OPTION 3	OPTION 4
EXISTING COMMUNITY & RECREATION FEATURES	° 6 features	° 2 features	° 2 features	° 17 features
EXISTING RESIDENTS	° 251 people along access route ° passes through Agerton (<25), Drumquin (<25), Derry West (110)	° 56 people along access route ° passes through Omagh (<25) and Derry West (110)	° 110 people along access route ° passes through Derry West (110)	° 441 people along access route ° passes through Derry West (110), Drumquin (<25), Meadowvale Village (230) & Meadowvale West (27,760 pop.)
TRANSPORTATION SAFETY	° 15.47 accidents per million vehicles	° 15.17 accidents per million vehicles	° 13.97 accidents per million vehicles	° 29.98 accidents per million vehicles
EXISTING AGRICULTURAL RESOURCES	° 23 active farm complexes ° sensitive crop value $187	° 18 active farm complexes ° sensitive crop value $76	° 11 active farm complexes ° sensitive crop value $81	° 22 active farm complexes ° sensitive crop value $351
STREAM CROSSINGS	° total 13 stream crossings ° crossing of Sixteen Mile Creek ° major constraint	° total 9 stream crossings ° crossing of Sixteen Mile Creek ° major constraint	° total 9 stream crossings ° crossing of Sixteen Mile Creek ° major constraint	° total 26 stream crossings ° crossing of Sixteen Mile Creek ° major constraint
HYDROGEOLOGY	° 5,600 m sensitive lands crossed	° 0 m sensitive lands crossed	° 200 m sensitive lands crossed	° 7,350 m sensitive lands crossed

TABLE 5.18

Overall Ranking of Preliminary Phase 4A Access Road Options

PI-13N to LF-2N

OPTION	RANKING	RATIONALE FOR RANKING
1	3	o high number of people along access route o high composite accident rate o highest number of active farm complexes
2	1	o fewest number of people along access route o low composite accident rate o lowest sensitive crop value o least length of hydrogeologically sensitive lands crossed
3	2	o low number of people along access route o lowest composite accident rate o lowest number of active farm complexes
4	4	o highest number of people along access route o highest number of community and recreation features o highest composite accident rate o high sensitive crop value o high number of active farm complexes o highest number of stream crossings o greatest length of hydrogeologically sensitive lands crossed

Option 3 is slightly preferred over Option 1 because of fewer residents and features along the access route, a lower composite accident rate and fewer active farm complexes.

The choice between Option 2 and Option 3 is a choice between fewer residents with Option 2 as compared with a slightly lower transportation accident rate and fewer farm complexes with Option 3. The more substantial difference in the number of residents potentially affected results in a slight overall preference for Option 2.

Table B.16 in Appendix B provides the results of quantitative analysis. The results of the quantitative analysis indicate that Option 3 is preferred over Option 2. The ranking for Options 1 and 4 are consistent with the ranking derived from an examination of major issues associated with each option.

Option 2 should be retained and carried forward to the detailed comparative evaluation of siting options. Options 1, 3 and 4 should be eliminated from further consideration in Phase 4A. However, the entire Fourth Line - Fifth Line corridor should be analyzed further in Phase 4B, if the LF-2N/PI-13N siting option is selected as the preferred siting option. The possibilities of connecting Fourth Line and the James Snow Parkway and/or upgrading and shifting the access road by one-half concession should also require further consideration in Phase 4B.

(f) LF-4N/PI-1N

The preferred access route from the south for LF-4N had been identified in Phase 3B.

(i) to LF-4N

For access from the north to LF-4N, the following two options remained:

1. from 401 - south on Fourth Line Road; west on Britannia Road to LF-4N (preferred - Phase 3 Report).

2. from 401 - south on Fourth Line; west on Derry Road; south on Highway 25; west on Britannia to LF-4N.

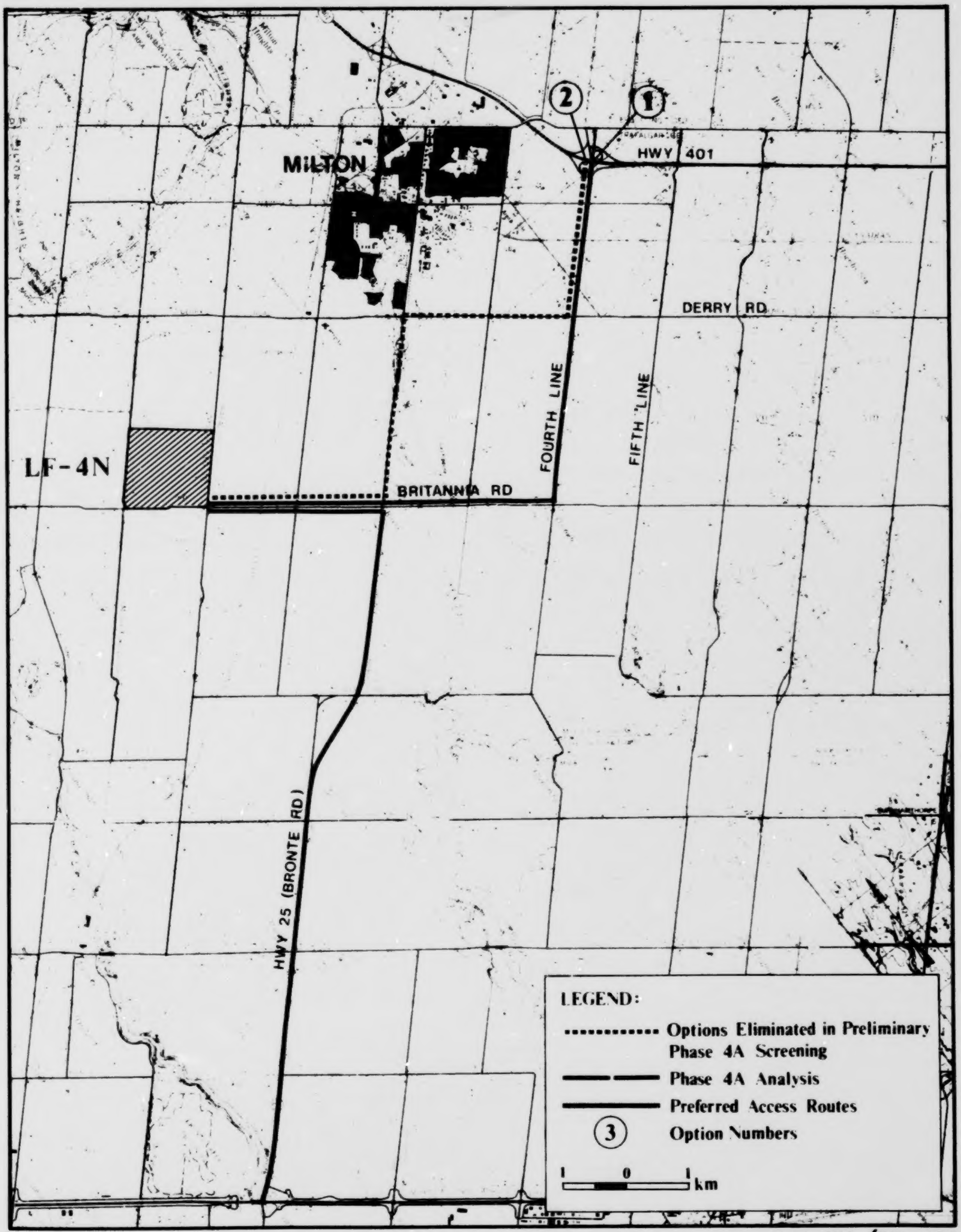
These options are illustrated on Figure 5.9. Option 1 was considered in the OWMC Phase 3 Report. Option 2 was identified in the early stages of Phase 4A. The consultants' rankings of these access road options are presented in Table B.17 in Appendix B.

A summary of the major issues pertaining to the access road options to LF-4N is provided in Table 5.19. Based on a review of these issues, the differences between the two options are minimal. The major difference between the two options is the number of people along the access road. There are nearly twice as many residents along Option 2 as compared to Option 1.

Based on a review of the major issues associated with each access road option, Option 1 is preferred over Option 2. Option 2 is less desirable because it passes through the Town of Milton.

Table B.18 in Appendix B provides the results of the quantitative analysis. The quantitative analysis indicates a preference for Option 2. Option 2 was preferred from a transportation safety and existing resources perspective. However, the differences between these two options are minimal, as reflected in the factor scores.

The minimization of impacts and risk to human health should take priority. Option 1 should be retained and carried forward to the detailed comparative evaluation of siting options. Option 2 should be eliminated from further consideration in Phase 4A.


②
①
MILTON
HWY 401
DERRY RD
FOURTH LINE
FIFTH LINE
LF-4N
BRITANNIA RD
HWY 25 (BRONTE RD)
LEGEND:
Options Eliminated in Preliminary Phase 4A Screening
Phase 4A Analysis
Preferred Access Routes
③ Option Numbers
1 0 1 km

LF-4N /PI-1N
TO LF-4N
PHASE 4A ACCESS ROADS
FIGURE 5.9

TABLE 5.19

Summary of Major Issues - Access Roads - LF-4N

OPTION FACTOR	OPTION 1	OPTION 2
EXISTING COMMUNITY & RECREATION FEATURES	° 5 features	° 2 features
EXISTING RESIDENTS	° 150 people along access route ° passes through Omagh (30 pop.), Boyne (< 25 pop.)	° 298 people along access route ° passes through Milton (29,591 pop.) and Boyne (< 25)
TRANSPORTATION SAFETY	° 47.29 accidents per million vehicles	° 41.48 accidents per million vehicles
EXISTING AGRICULTURAL RESOURCES	° 12 active farm complexes ° sensitive crop value $132.9	° 12 active farm complexes ° sensitive crop value $150.0
STREAM CROSSINGS	° total 13 stream crossings ° crossings of Sixteen Mile Creek and tributaries to Bronte Creek ° major constraint	° total 11 stream crossings ° crossing Sixteen Mile Creek ° major constraint
HYDROGEOLOGY	° 1400 m sensitive lands crossed	° 1400 m sensitive lands crossed

(g) LF-1E/PI-27E

i) to LF-1E

The access route options to LF-1E have been previously discussed in the consideration of LF-1E as an integrated siting option.

ii) PI-27E to LF-1E

Five access routes were identified as intersite transfer routes for the partially integrated siting option LF-1E/PI-27E. These options are shown on Figure 5.10 and include:

1. east on Biggar Road (Regional Road 47); south on Regional Road 98 (Montrose Road); west on Carl Road to LF-1E.

2. west on Biggar Road; south on Morris Road to LF-1E.

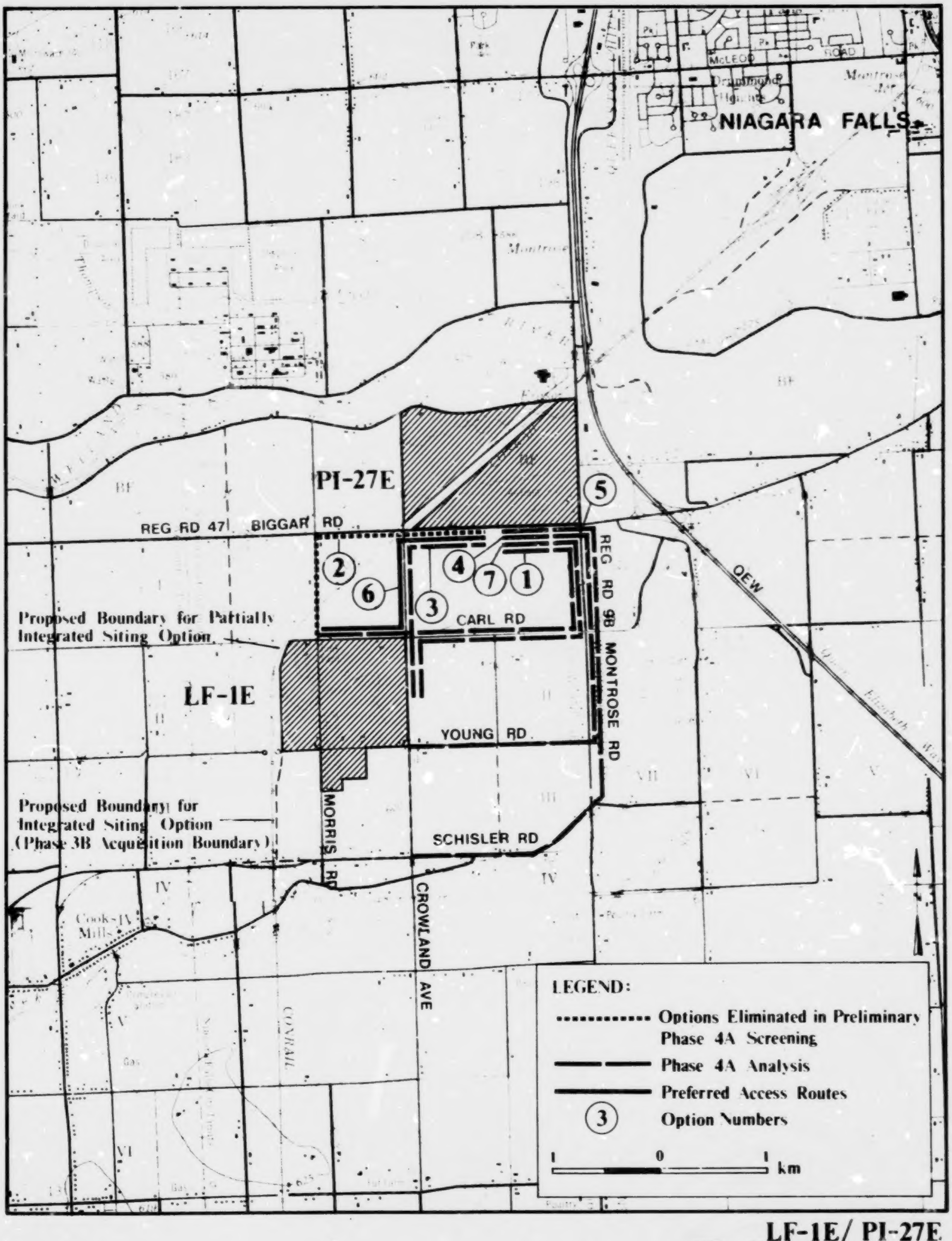
3. west on Biggar Road; south on Crowland Road to LF-1E.

4. east on Biggar Road (Regional Road 47); South on Regional Road 98 (Montrose Road); west on Young Road to LF-1E.

5. east on Biggar Road (Regional Road 47); south on Regional Road 98 (Montrose Road); west on Schisler Road (Regional Road 27) to LF-1E.

Option 1 was included in the OWMC Phase 3 Report. Options 2, 3 and 4 were identified by the transportation consultant at the outset of Phase 4A The consultants' rankings of these access road options are presented in Table B.19 in Appendix B.

A summary of the major issues pertaining to the intersite transfers between PI-27E and LF-1E is provided in Table 5.20.


NIAGARA FALLS
McLEOD
ROAD
Drummond Heights
Montrose
RIVER
PI-27E
LF-1E
REG RD 47 BIGGAR RD
CARL RD
YOUNG RD
SCHISLER RD
REG RD 98
MONTROSE RD
MORRIS RD
CROWLAND AVE
QEW
Queen Elizabeth Way
CONRAIL
Cooks Mills
BF
II
III
IV
V
VI
VII
Proposed Boundary for Partially Integrated Siting Option
Proposed Boundary for Integrated Siting Option (Phase 3B Acquisition Boundary)
1
2
3
4
5
6
7
LEGEND:
Options Eliminated in Preliminary Phase 4A Screening
Phase 4A Analysis
Preferred Access Routes
Option Numbers
1
0
1
km

LF-1E/ PI-27E
PI - 27E TO LF - 1E
PHASE 4A ACCESS ROADS
FIGURE 5.10

Based on a review of the major issues associated with each access road option, the differences among the options are slight. In particular, the differences between Options 1, 3, 4 and 5 are minimal. The selection of a final intersite transfer route for this siting option is dependent upon the final refinement to the site boundaries. A ranking of access road options was, therefore, not derived.

Option 2 should, however, be eliminated from further consideration in Phase 4A because two level railway crossings pose a relatively greater risk from a transportation safety perspective.

Table B.20 provides the results of the quantitative analysis. The analysis provides a ranking of access road options from most to least preferred as follows: Options 4, 1, 3, 2 and 5. The quantitative analysis does not provide a sufficient basis to exclude any further options.

On the basis of the above, Options 1, 3, 4 and 5 should be retained and examined further in Phase 4A. Option 2 should be eliminated from further consideration.

iii) to PI-27E

Two access route options remained to PI-27E. These options are shown in Figure 5.11 and include the following:

1. from QEW - west on Regional Road 47 (Lyons Creek Road/Biggar Road) to PI-27E (preferred - Phase 3 Report).

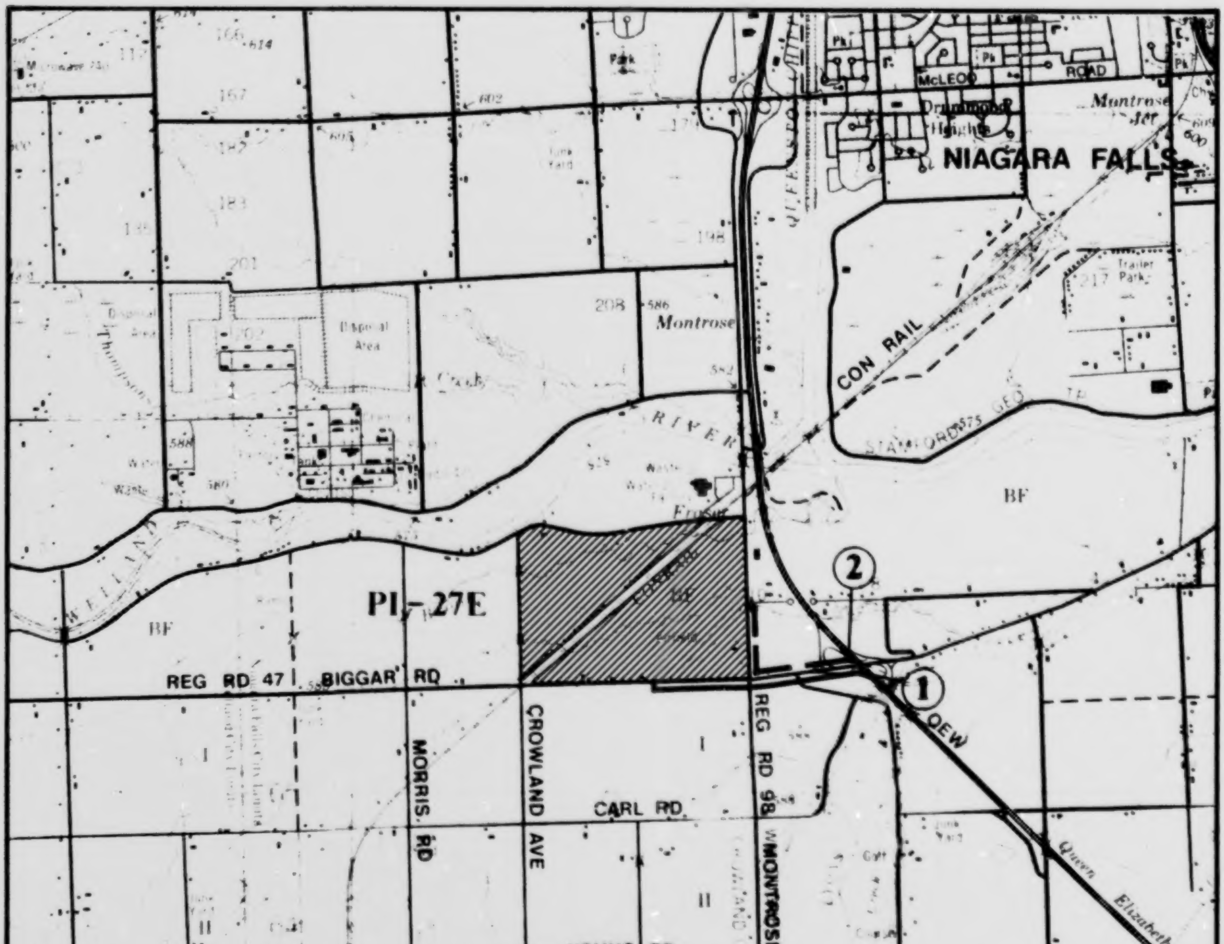
2. from QEW - west on Regional Road 47; north on Regional Road 98 to PI-27E.

The access routes involve direct access from the QEW to Regional Road 47 (Lyons Creek Road/Biggar Road).

TABLE 5.20

Summary of Major Issues - Access Roads - PI-27E to LF-1E

OPTION FACTOR	OPTION 1	OPTION 2	OPTION 3	OPTION 4	OPTION 5
EXISTING COMMUNITY & RECREATION FEATURES	° 1 feature	° 0 features	° 0 features	° 1 feature	° 4 features
EXISTING RESIDENTS	° 28 people along access route	° 31 people along access route	° 25 people along access route	° 38 people along access route	° 38 people along access route
TRANSPORTATION SAFETY	° 7.68 accidents per million vehicles	° 4.21 accidents per million vehicles ° two level railway crossings	° 4.78 accidents per million vehicles ° one level railway crossing	° 7.29 accidents per million vehicles	° 11.30 accidents per million vehicles
EXISTING AGRICULTURAL RESOURCES	° 2 active farm complexes ° sensitive crop value $133	° 3 active farm complexes ° sensitive crop value $34.5	° 2 active farm complexes ° sensitive crop value $20.5	° 1 active farm complex ° sensitive crop value $25.0	° 1 active farm complex ° sensitive crop value $60.4
STREAM CROSSINGS	° total 3 stream crossings ° no constraint	° 0 stream crossings	° 0 stream crossings	° total 3 stream crossings ° no constraint	° total 4 stream crossings ° minor constraint
HYDROGEOLOGY	° 150 m sensitive lands crossed	° 0 m sansitive lands crossed	° 0 m sensitive lands crossed	° 150 m sensitive lands crossed	° 1200 m sensitive lands crossed


NIAGARA FALLS
McLEOD ROAD
Drummond Heights
Montrose Jct
CON RAIL
STAMFORD
Montrose
WELLAND RIVER
PI-27E
BF
REG RD 47 BIGGAR RD
MORRIS RD
CROWLAND AVE
CARL RD
REG RD 98 MONTROSE RD
YOUNG RD
SCHISLER RD
QEW
Queen Elizabeth Way
Cooks Mills
Compressor Station
Gas
CONRAIL
Niagara Falls City Limits
Fur Farm
Poultry Farm
Golf Course
Junk Yard
Trailer Park
Disposal Area
Waste
I
II
III
IV
V
VI
VII
①
②
LEGEND:
Options Eliminated in Preliminary Phase 4A Screening
Phase 4A Analysis
Preferred Access Routes
③ Option Numbers
1 0 1 km

LF-1E /PI-27E
TO PI-27E
PHASE 4A ACCESS ROADS
FIGURE 5.11

In reviewing the access road options to LF-1E and for the intersite transfer between PI-27E and LF-1E, the differences between the options in the vicinity of LF-1E/PI-27E are minimal. The selection of final access routes for this siting option is dependent upon the final refinement to the site boundaries. The consideration of access road options to PI-27E should, therefore, be deferred to the more detailed Phase 4A analysis of access road options.

5.2.5 CONCLUSIONS

Preferred access road options were identified for LF-9C, PI-1N, PI-1N to LF-2N, PI-13N, PI-13N to LF-2N and LF-4N.

5.3 PHASE 4A ACCESS ROAD ANALYSIS

5.3.1 APPROACH

The second level of analysis or Phase 4A analysis of access route options resulted in the selection of preferred access routes for each siting option. This analysis is based on a much broader range of factors and consequently a more detailed data base. The process and assumptions used to compare the access road options are essentially the same as those employed in the preliminary Phase 4A analysis of access road options.

Access road options were examined for the following: LF-3C, LF-1E, PI-27E, PI-27E to LF-1E and PI-1N to LF-4N. The following site selection consultants were involved in the Phase 4A comparative evaluation of access road options: M.M. Dillon-Transportation, Gartner Lee Associates Ltd., Leon Kentridge Associates Ltd., Ecologistics Ltd. and Institute of Environmental Research Inc. Risks, impacts and costs were examined at this stage of the analysis.

The site selection consultants employed a much broader range of factors than those employed in the preliminary Phase 4A analysis. This additional level of detail was sufficient to differentiate and rank the remaining options as well as to substantiate the conclusions and recommendations.

A study zone of 800 m on either side of the access road was used to examine potential impacts of potential incidents involving tank trailers carrying a flammable solvent for purposes of the comparative evaluation of access road options. The 800 m study zone, also covers the potential impact of noise, visual intrusion, traffic interference, changes in traffic safety and land use conflict. An explanation of how the 800 m impact zone was derived is contained in Appendix C.

5.3.2 IDENTIFICATION OF FACTORS AND INDICATORS

The factor identification process began with a preliminary identification of possible factors by the site selection consultants. Each factor is subdivided into indicators.

The factors and indicators used by the site selection team to compare the access route options are listed in Table 5.21. A rationale for these factors is provided in Table B.21 in Appendix B.

5.3.3 RANKING OF FACTORS

5.3.3.1 Introduction

The evaluation procedures employed by the site selection consultants varied depending on the nature of the data. The consultants ranked their factors and the access road options. They also provided rationales for factor and option rankings. The scaling* of data, based on the distribution of options under consideration, and the application of factor weights were additional evaluation steps that could be undertaken, where appropriate.

TABLE 5.21

Factors Used in Phase 4A Analysis of Access Route Options

FACTOR GROUPING	FACTOR	INDICATOR
A. RISK		
° Transportation Risk	° accident probability and safety of transport (along preferred access routes from 400 series highway to site)	° composite annual accident rate (acc./mil. veh. km)
		° number of public intersections where a turn is required
		° peak hour volume to capacity ratio
	° number and characteristics of people along access routes	° population concentrations
		° number and characteristics of populations using community and recreation features
	° operations of community and recreation features	° number and characteristics of community and recreation features
	° transportation risk to surface water	° stream length through land with sensitive water use
		° length of access route at high risk of waste entry to a stream in the event of a transportation spill (m)

TABLE 5.21

Factors Used in Phase 4A Analysis of Access Route Options

FACTOR GROUPING	FACTOR	INDICATOR
B. ENVIRONMENTAL IMPACTS		
° Residents	° displacement of residents	° number of residents
	° disruption of day-to-day activities and use and enjoyment property	° number of residents
° Community and Recreation Features	° displacement of community and recreation features	° number and characteristics of community and recreation features
	° disruption of operations of community and recreation features	° number and characteristics of community and recreation features
° Land Use Impacts	° existing land use	° number of residences
		° number of commercial facilities
	° proposed and planned land use	° land use designations
		° vacant lots of record

TABLE 5.21

Factors Used in Phase 4A Analysis of Access Route Options

FACTOR GROUPING	FACTOR	INDICATOR
B. ENVIRONMENTAL IMPACTS		
° Agricultural Resources	° farm businesses along access roads	° farm machinery movements (km/year) ° livestock housed (animal units - livestock and poultry) ° number of cattle (herd) crossings/year ° number of service vehicles stops/year ° number of customer stops/year ° loss of land (class 1 equivalents) (ha) ° area of crops within 800 m (ha)
° Natural Environment	° transportation impact on fish communities	° downstream length of locally significant fishery ° downstream length of regionally significant fishery

TABLE 5.21

Factors Used in Phase 4A Analysis of Access Route Options

FACTOR GROUPING	FACTOR	INDICATOR
C. COST		
° Transportation Costs	° road improvement costs	° road improvement construction costs (000s of dollars) ° right of way required (hectares)

Each consultant developed and adopted an evaluation procedure most appropriate to the factors employed and to the nature of the data base.

5.3.3.2 Screening of Factors

The factors employed in the comparative evaluation of access road options represent risks, impacts and costs. Within the impact factors there was a degree of double counting to avoid overstating potential impacts. Factors were screened from the analysis.

Table 5.22 indicates the factors screened from the analysis. It also provides a rationale for screening.

Table 5.23 indicates the list of final factors employed in the Phase 4A comparative evaluation of access road options.

5.3.3.3 Ranking of Factors - Individual Consultants

Table B.22 in Appendix B indicates the ranking of factors by the other site selection consultants and the rationale for those rankings. Further details regarding the ranking of access road factors for the Phase 4A comparative evaluation of access road options are provided in the consultants' Phase 4A technical reports.

5.3.3.4 Overall Ranking of Factors

An overall ranking of factors was necessary before an overall ranking of access road options could be derived.

The factors employed in the comparative evaluation of access road options were assigned a rank from 5 to 1, from most important to least important. The five ranking levels were sufficient to rank the access road factors.

TABLE 5.22

Screening of Factors

FACTOR SCREENED	RATIONALE FOR SCREENING
° displacement of residents	° no residents displaced with any access road option
° displacement of community and recreation features	° no community and recreation features displaced with any access road option
° existing land use	° existing land use pattern indicator screened by land use consultant ° number of residences already addressed as number of residents under the disruption of day-to-day activities use and enjoyment of property factor ° commercial facilities considered a minor consideration; few occurrences of commercial facilities; could be a potentially positive consideration ° potential land use impacts will be considered only in event that all other factors considered equal
° planned and proposed land use	° considered a minor factor ° future land use considered mitigable ° potential land use impacts will be considered, only in the event that all other factors considered equal
° vacant lots of record	° considered a minor land use factor ° little variation across siting options ° vacant lots of record will only be considered in the event that all other factors considered equal

TABLE 5.23

Final Factors Employed in Phase 4A Comparative Evaluation of Access Road Options

FACTOR GROUPING	FACTOR
A. RISK	
° Transportation Risk	° accident probability and safety ° number of residents ° operations of community and recreation features ° transportation risk to surface water
B. ENVIRONMENTAL IMPACTS	
° Residents	° disruption of day-to-day activities and the use and enjoyment of property
° Community and Recreation Features	° disruption of operations of community and recreation features
° Agricultural Resources	° farm businesses along access roads
° Natural Environment	° impact on fish communities
C. COST	
° Transportation Costs	° road improvement costs

The overall factor rankings used in the comparative evaluation of access road options and a rationale for the ranking are provided in Table 5.23.

5.3.4 APPLICATION OF FACTORS - COMPARATIVE EVALUATION

Integrated Siting Options

(a) LF-3C

Two access route options remained for integrated site LF-3C. These options are illustrated on Figure 5.2 and included the following:

1. from QEW - south on Vineland Townline Road (Regional Road 24); west on Highway 20; south on Regional Road 27; west on Elcho Road to LF-3C (preferred - Phase 3 Report);

6. from QEW - south on Vineland Townline Road (Regional Road 24); west on Highway 20; west on Regional Road 65 from Bismarck; south on Krick Road to LF-3C.

Options 2, 3, 4 and 5 were eliminated in the preliminary Phase 4A analysis of access road options.

The consultants' rankings are provided in Table B.23 in Appendix B. The local access options of Elcho and Krick Roads represent the only difference between the two options.

A summary of the major issues pertaining to access road options to LF-3C is provided in Table 5.24. Based on a review of the major issues associated with each access road option, Option 6 is the preferred access road option. The major reasons for this conclusion include the following:

TABLE 5.24

Overall Ranking of Factors

FACTOR RANK	FACTOR	RATIONALE FOR FACTOR RANK
5	° accident probability and safety	° transportation safety addresses the probability of transportation accidents associated with the transport of special wastes and additives and reagents ° possibility of an accident dependent upon the existing characteristics of roads used ° minimization of risk highest ranked OWMC goal
	° number of residents	° in the remote event of an accidental release of untreated waste, human exposure could represent a potential concern ° emphasis placed upon access route that would minimize population exposure
	° disruption of day-to-day activities and the use and enjoyment of property	° the major day-to-day concerns associated with access routes would be the potential disturbance to the use and enjoyment of property as a result of truck noise and potential interference with property access and local traffic movements ° highest priority given to the minimization of impact on residents
4	° farm businesses along access roads	° agriculture is an important concern in terms of potential interference with farm vehicle movements and potential effects on farm operations ° desirable to minimize impact on agricultural resources

TABLE 5.24

Overall Ranking of Factors

FACTOR RANK	FACTOR	RATIONALE FOR FACTOR RANK
3	° disruption of operations of community recreation features	° in the remote event of an accidental release of untreated waste, human exposure could represent a potential concern ° less importance attached to features than residents because of frequency of use and occurrence ° emphasis placed upon access route that would minimize exposure of users of community and recreation features
2	° impact on fish communities	° factor considers the potential impact on fish communities as a result of an accidental release of untreated waste ° surface waters provide a pathway for the rapid movement of contaminants ° an accidental release of contaminants into a stream course could represent a serious concern ° at the same time the likelihood of an accidental spill in transit is very remote and the likelihood that such a spill would involve a direct release into a major water course is even more remote
2	° transportation risk to surface water	° factor considers the potential risk to human health that may occur as a result of a spill ° surface water could provide a pathway for the rapid movement of contaminants in the event of a spill

TABLE 5.24

Overall Ranking of Factors

FACTOR RANK	FACTOR	RATIONALE FOR FACTOR RANK
	° transportation risk to surface water (cont'd)	° possible increased risk to human health and the restriction of use of downstream surface water could result ° emergency clean-up crews would respond promptly ° the likelihood of an accidental spill in transit is very remote
1	° road improvement costs	° cost is lowest ranked OWMC goal ° viewed as a minor consideration in the comparative evaluation of access road options

- Option 6 has fewer adjacent residents;

- Option 6 has a lower composite accident rate and fewer intersections where a turn is required. The two turns associated with Option 6 could be eliminated through a jog elimination.

- Option 1 has fewer farm machinery movements, no cattle crossings and involves no loss of Class 1 equivalent land. However, the agricultural consultant concluded that the impacts on farms along Elcho Road would be greater than along Krick Road. The cattle crossings on Krick Road could potentially be mitigated with an underpass. There is a high density of farms on Elcho Road. There are no farm headquarters on Krick Road.

Table B.24 in Appendix B provides the results of the quantitative analysis. The results of this analysis are consistent with the ranking derived from an examination of major issues associated with each option.

On the basis of the above, Option 6 should be retained and carried forward to the detailed comparative evaluation of siting options. Option 1 should be eliminated from further consideration in Phase 4A.

(b) LF-1E

After the preliminary screening of access roads in the Phase 4A, four access route options remained for integrated site LF-1E. These options included:

1. from QEW - west on Regional Road 47 (Lyons Creek Road/Biggar Road); south on Regional Road 98 (Montrose Road); west on Carl Road to LF-1E (preferred - Phase 3 Report).

3. from QEW - west on Regional Road 47 (Lyons Creek Road/Biggar Road); south on Crowland Road to LF-1E.

TABLE 5.25

Summary of Major Issues - Access Roads - LF-3C

	FACTOR OPTION	OPTION 1	OPTION 6
• Transportation Risk	• accident probability and safety	• 52.96 accidents per million vehicles • 4 intersections where a turn is required	• 47.91 accidents per million vehicles • 2 intersections where a turn is required
	• number of residents	• 105 residents adjacent to access road	• 63 residents adjacent to access road
	• operations of community and recreation features	• one community feature adjacent to access road	• one community feature adjacent to access road
	• transportation risk to surface water	• stream crossing distance - 5,945 m • downstream water use index - 823	• stream crossing distance - 6,205 m • downstream water use index - 895
• Environmental Impacts	• disruption of day-to-day activities and the use and enjoyment of property	• 105 residents adjacent to access road	• 63 residents adjacent to access road
	• disruption of operations of community and recreation features	• one community feature adjacent to access road	• one community feature adjacent to access road
	• farm businesses along access roads	• 0 ha loss of Class 1 equivalents • 42,648 farm machinery movements • 0 cattle crossings	• 1.27 ha loss of Class 1 equivalents • 56,630 farm machinery movements • 517 cattle crossings
	• impact on fish communities	• 344.2 km of locally significant fishery • length of regionally significant fishery equal for both options • low constraint	• 373.9 km of locally significant fishery • length of regionally significant fishery equal for both options • high constraint
• Cost	• road improvement costs	• $453,000 • no additional right-of-way required	• $1,147,000 • 1.43 ha of additional right-of-way required

4. from QEW - west on Regional Road 47 (Lyons Creek Road/Biggar Road); south on Regional Road 98; west on Young Road to LF-1E.

5. from QEW - west on Regional Road 47 (Lyons Creek Road/Biggar Road); south on Montrose Road; west on Schisler Road (Regional Road 27) to LF-1E.

However, before a final selection of a preferred access route to LF-1E, the boundaries for LF-1E had to be finalized. After refining the site boundaries for LF-1E, the access route options for LF-1E were re-examined. Based on this re-examination, Options 3 and 4 should be eliminated from further consideration. The reasons for this conclusion include:

- Schisler Road (Option 5) no longer provides access to the physical/chemical treatment plant and incinerator portion of the site;

- Young Road (Option 4) no longer provides access to the physical/chemical treatment plant and incinerator portion of the site.

The access routes with the most potential for providing access to LF-1E were:[1]

1. from QEW - west on Regional Road 47 (Lyons Creek Road/Biggar Road); south on Regional Road 98 (Montrose Road); west on Carl Road to LF-1E.

3. from QEW - west on Regional Road 47 (Lyons Creek Road/Biggar Road); south on Crowland Road to LF-1E.

---

[1] Option 2 was eliminated in the preliminary Phase 4A analysis of access road options.

6. from QEW - west on Regional Road 47 (Lyons Creek Road/Biggar Road); south on Crowland Road; west on Carl Road to LF-1E.

7. from QEW - west on Regional Road 47 (Lyons Creek Road/Biggar Road); south on Montrose Road; west on Carl Road; south on Crowland Road to LF-1E.

Those options are illustrated on Figure 5.4. The consultants' rankings are provided in Table B.25 in Appendix B.

A summary of the major issues pertaining to access road options to LF-1E is provided in Table 5.25. The ranking of access road options and a rationale for the ranking is provided in Table 5.26. There are no differences among the options based on risks and impacts on residents and community and recreation features.

Based on a review of the major issues associated with each access road option, Option 6 is the most preferred. Option 7 as least preferred. Option 6 is the most preferred for the following reasons:

- there are no differences among the options in terms of residents and community and recreational features;
- Option 6 has a low accident rate;
- Option 6 has no surface water constraint and a low fisheries constraint;
- Option 6 has a relatively low number of farm machinery movements.

Table B.26 in Appendix B provides the results of the quantitative analysis. The results of this analysis indicate the same rankings for Options 1 and 7. However Option 3 is ranked higher than Option 6. The

Table 5.26

Summary of Major Issues - Access Roads - LF-1E

FACTOR	OPTION	OPTION 1	OPTION 3	OPTION 6	OPTION 7
• Transportation Risk	• accident probability and safety	- 7.95 accidents per million vehicles - 2 intersections where a turn is required	- 5.55 accidents per million vehicles - 1 intersection where a turn is required	- 6.03 accidents per million vehicles - 2 intersections where a turn is required	- 9.47 accidents per million vehicles - 3 intersections where a turn is required
	• number of residents	- less than 50 residents adjacent	- less than 50 residents adjacent	- less than 50 residents adjacent	- less than 50 residents adjacent
	• operations of community and recreation features	- one feature adjacent	- one feature adjacent	- one feature adjacent	- one feature adjacent
	• transportation risk to surface water	- stream crossing distance 380 m. - downstream surface water use index - 22	- stream crossing distance 100 m. - downstream surface water use index - 10	- stream crossing distance 0 m. - downstream surface water use index - 0	- stream crossing distance 480 m. - downstream surface water use index - 35
• Environmental Impacts	• disruption of day-to-day activities and the use and enjoyment of property	- less than 50 residents adjacent	- less than 50 residents adjacent	- less than 50 residents adjacent	- less than 50 residents adjacent
	• disruption of operations of community and recreation features	- one feature adjacent	- one feature adjacent	- one feature adjacent	- one feature adjacent
	• farm businesses along access roads	- 524 farm machinery movements	- 270 farm machinery movements	- .26 ha of Class 1 equivalents - 290 farm machinery movements	- 505 farm machinery movements
	• impact on fish communities	- 19.4 km. of locally significant fishery - low constraint	- 9.7 km. of locally significant fishery - low constraint	- 0 km. of locally significant fishery - low constraint	- 29.1 km. of locally significant fishery - medium constraint
• Cost	• road improvement costs	- $171,000 - no additional right-of-way required	- $672,700 - 0.4 ha of additional right-of-way required	- $693,200 - 0.4 ha of additional right-of-way required	- $151,000 - no additional right-of-way required

TABLE 5.27

Overall Ranking of Access Road Options - LF-1E

OPTION	RANKING	RATIONAL FOR RANKING
1	3	° high accident rate ° high surface water constraint ° high number of farm machinery movements ° low fisheries constraint
3	2	° low accident rate ° low surface water constraint ° lowest number of farm machinery movements of all options ° low fisheries constraint
6	1	° low accident rate ° no surface water constraints ° low number of farm machinery movements ° low fisheries constraint
7	4	° highest accident rate of all options ° highest stream crossing distance and downstream surface water use index ° high number of farm machinery movements ° medium constraint in terms of impact on fish community

differences between the two options are very limited, except for potential surface water risks and potential impact on fish communities. Option 6 is, therefore, still preferred.

Partially Integrated Options

The comparison of partially integrated access route options was somewhat more complex than the comparison of access route options for fully integrated facilities. In the case of partially integrated facilities it was necessary to evaluate three sets of options as follows:

- access to the PI site;
- access to the LF site from the PI site;
- access to the LF site (in the event that a physical/chemical treatment plant is located at the landfill).

The differences among these sets of options are highlighted in the following subsections.

(c) LF-4N/PI-1N

The preferred access route for intersite transfers from PI-1N to LF-4N was selected in Phase 3B as:

West on Britannia Road to LF-4N.

This conclusion was made prior to boundary refinement for PI-1N. In Phase 4A, the boundaries for PI-1N were refined. The intersite transfer route for LF-4N/PI-1N was reconsidered. The refined boundaries indicated that intersite transfers to LF-4N would have to access PI-1N via either Highway 25 (Bronte Road) or First Line.

The following options were, therfore, compared:

1. north on Highway 25 (Bronte Road); west on Britannia Road to LF-4N.

2. north on First Line; west on Britannia Road to LF-4N.

These options are shown on Figure 5.12. The consultants' rankings for options are provided in Table B.27 in Appendix B.

Option 2 should be retained as the preferred access road for intersite transfers between PI-1N and LF-4N. The reasons for this conclusion include the following:

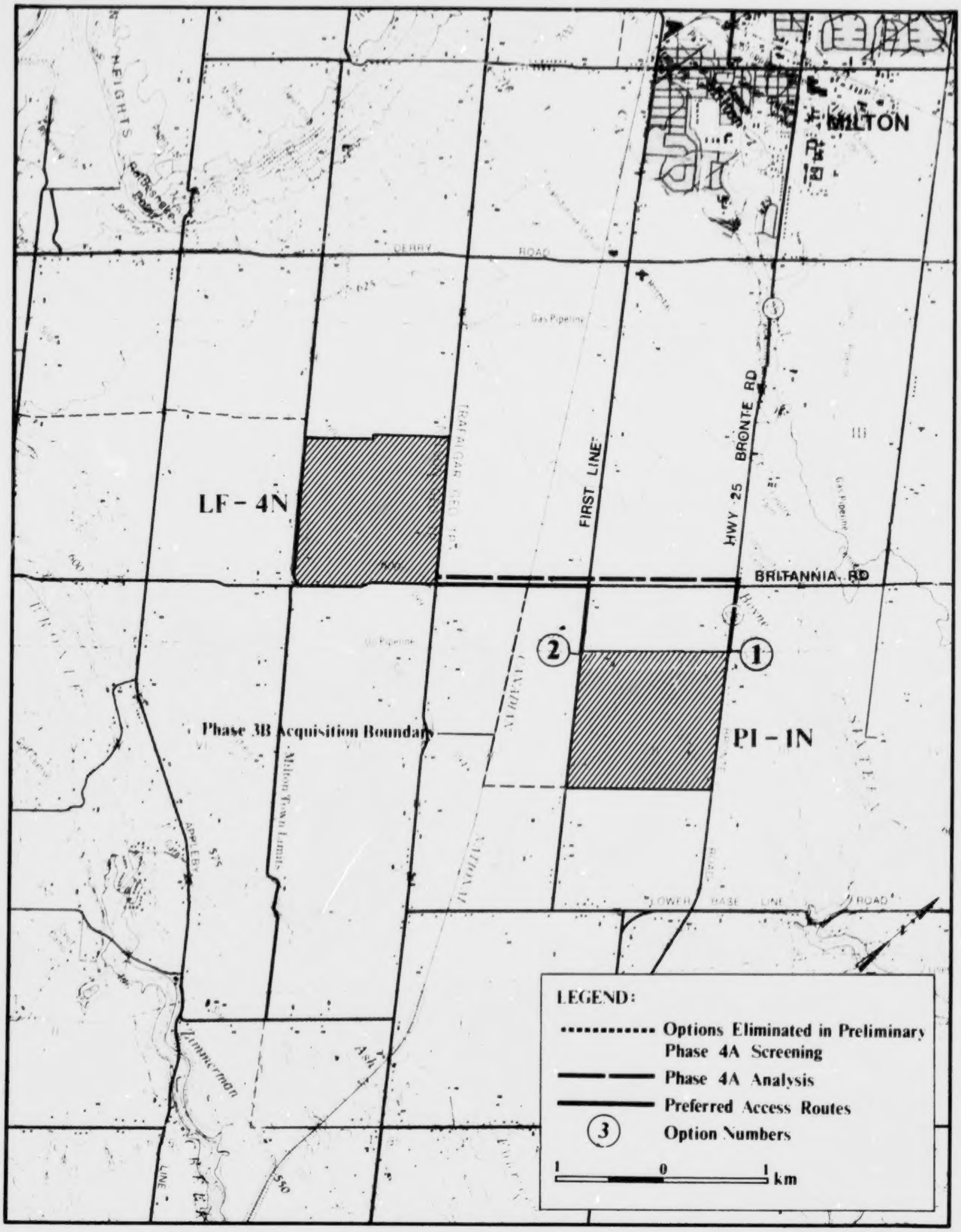
- Option 1 involves travel through Boyne. Option 2 avoids Boyne;

- Option 2 avoids a left turn from Highway 25 to Britannia Road;

- Both options have less than 50 adjacent residents and one adjacent recreation feature. Option 1 has an additional 54 residents and 3 community features within the 800 m. study area. Option 2 has an additional 32 residents and no community features within the 800 m. study area.

A quantitative analysis was not undertaken because Option 2 was preferred to Option 1 for almost all factors.

Option 1 should, therefore, be eliminated from further consideration in Phase 4A.


MILTON
DERRY ROAD
Gas Pipeline
TRAFALGAR GEO TP
FIRST LINE
HWY 25 BRONTE RD
LF - 4N
BRITANNIA RD
2
1
PI - 1N
Phase 3B Acquisition Boundary
Milton Town Limits
APPLEBY LINE
LOWER BASE LINE ROAD
Zimmerman
LEGEND:
Options Eliminated in Preliminary Phase 4A Screening
Phase 4A Analysis
Preferred Access Routes
3
Option Numbers
1
0
1 km

LF-4N/ PI-1N
PI - 1N TO LF-4N
PHASE 4A ACCESS ROADS
FIGURE 5.12

(d) LF-1E/PI-27E

i) to PI-27E

After the preliminary screening of access roads in Phase 4A, two options remained for access to PI-27E.

These options are:

1. from QEW - west on Regional Road 47 (Lyons Creek Road/Biggar Road) to PI-27E.

2. from QEW - west on Regional Road 47 (Lyons Creek Road/Biggar Road); north on Regional Road 98 to PI-27E.

These options are shown on Figure 5.11. The consultants' rankings are provided in Table B.28 in Appendix B.

Option 1 should be retained as the preferred access road to PI-27E. The major reasons for this conclusion include the following:

- the only differences between the two options are in terms of transportation probability and safety and impact on fish communities and cost. Option 1 is favoured for transportation probability and safety and impact on fish communities. Option 2 is favoured for road improvement costs;

- cost is a minor factor.

A quantitative analysis was not undertaken. The results of this analysis would support the preference for Option 1 for all but one factor.

Option 2 should, therefore, be eliminated from further consideration in Phase 4A.

ii) PI-27E to LF-1E

The intersite transfer route options between PI-27E and LF-1E are essentially the same as those options to LF-1E, with the exception of a short distance along Regional Road 47 between the QEW and the entry point to PI-27E. The intersite transfer route options between PI-27E and LF-1E are:

1. from PI-27E - east on Regional Road 47 (Lyons Creek Road/Biggar Road; south on Regional Road 98 (Montrose Road); west on Carl Road to LF-1E.

3. from PI-27E - west on Regional Road 47 (Lyons Creek Road/Biggar Road; south on Crowland Road to LF-1E.

6. from PI-27E - west on Regional Road 47 (Lyons Creek Road/Biggar Road); south on Crowland Road; west on Carl Road to LF-1E.

7. from PI-27E - east on Regional Road 47 (Lyons Creek Road/Biggar Road); south on Montrose Road; west on Carl Road; south on Crowland Road to LF-1E.

Option 6 should be retained as the preferred option for intersite transfer movements between PI-27E and LF-1E for the same reasons described for integrated siting option LF-1E.

5.3.5 CONCLUSIONS

The preferred access routes for each siting option and the stage at which they were selected are listed in Table 5.27. The preferred access routes for each siting option, selected in either Phase 3 or Phase 4A, were carried forward to the detailed comparative evaluation of siting options.

TABLE 5.28

Preferred Access Routes

	SELECTED IN PHASE 3B	SELECTED IN PRELIMINARY PHASE 4A ANALYSIS	SELECTED IN PHASE 4A ANALYSIS
1. **to LF-3C**			
o From QEW - south on Vineland Townline Road (Regional road 24); west on Highway 20; west on Regional Road 65 from Bismarck; south on Krick Road to LF-3C			0
2. **to LF-9C**			
o From QEW - south on Vineland Townline Road (Regional Road 24); west on Highway 20 to LF-9C		0	
3. **to LF-1E**			
o From QEW - west on Regional Road 47 (Lyons Creek Road/Biggar Road); south on Crowland Road; west on Carl Road to LF-1E			0
4. **LF-2N/PI-1N**			
a) **to LF-2N**			
o From 401 - north on Highway 10 to LF-2N	0		
o From 410 - west on Derry Road West to LF-2N	0		

TABLE 5.28

Preferred Access Routes

	SELECTED IN PHASE 3B	SELECTED IN PRELIMINARY PHASE 4A ANALYSIS	SELECTED IN PHASE 4A ANALYSIS
4. LF-2N/PI-1N - Continued			
b) to PI-1N			
o From 401 - south on Fourth Line; west on Britannia Road to PI-1N		0	
o From QEW - north on Highway 25 (Bronte Road) to PI-1N	0		
c) PI-1N to LF-2N			
o East on Britannia Road; north on Fourth Line Road; east on Highway 401; north on Highway 10 to LF-2N		0	
5. LF-2N/PI-13N			
a) to PI-13N			
o From 401 - south on Fourth Line Road; east on Britannia Road; south on Fifth Line Road to PI-13N		0	
o From QEW - north on Highway 25 (Bronte Road); east on Britannia Road; south on Fifth Line Road to PI-13N	0		

TABLE 5.28

Preferred Access Routes

	SELECTED IN PHASE 3B	SELECTED IN PRELIMINARY PHASE 4A ANALYSIS	SELECTED IN PHASE 4A ANALYSIS
4. **LF-2N/PI-13N** - Continued			
b) **to PI-13N to LF-2N**			
o North on Fifth Line Road; west on Britannia Road; north on Fourth Line Road; east on Highway 401; north on Highway 10 to LF-2N		0	
6. **LF-4N/PI-1N**			
a) **to LF-4N**			
o From 401 - south on Fourth Line Road; west on Britannia Road to LF-4N		0	
o From QEW - north on Highway 25 (Bronte Road); west on Britannia Road to LF-4N	0		
b) **PI-1N to LF-4N**			
o North on First Line Road; west on Britannia Road to LF-4N			0

TABLE 5.28

Preferred Access Routes

	SELECTED IN PHASE 3B	SELECTED IN PRELIMINARY PHASE 4A ANALYSIS	SELECTED IN PHASE 4A ANALYSIS
7. **LF-4N/PI-13N**			
a) **PI-13N to LF-4N**			
o North on Fifth Line; west on Britannia Road to LF-4N	0		
8. **LF-1E/PI-27E**			
a) **to PI-27E**			
o From QEW - west on Regional Road 47 (Lyons Creek Road/Biggar Road) to PI-27E			0
b) **to PI-27E to LF-1E**			
o West on Regional Road 47 (Lyons Creek Road/Biggar Road); south on Crowland Road; west on Carl Road to LF-1E			0

6.0 RAIL ACCESS OPTIONS

6.1 INTRODUCTION

6.1.1 PURPOSE

Before it was possible to compare the siting options, it was first necessary to define precisely the major characteristics of each option. The identification of a preferred rail access to the physical/chemical treatment component of each siting option, where desirable, was one element of the process of refining siting options.

The provision of rail access to a candidate site is as an opportunity rather than as an absolute requirement. Rail service is not essential for site development. The major benefit associated with the rail bulk haulage of process additives and reagents is a reduction in both road transport haulage and in the cost of transport of these materials to an integrated or partially integrated site.

6.1.2 STEPS

The analysis of rail access options was conducted in two steps:

i. The preparation of constraint maps to assist in the identification of rail access options.

ii. The comparative evaluation of rail access options into each site.

The selection of a preferred rail access option was dependent on the refinement of site boundaries for LF-3C, PI-1N and LF-1E and upon the selection of a preferred access route. Rail access options were identified in parallel with boundary refinement and access road identification to expedite the refinement of siting options. The implications of the boundary refinement and access road analysis were considered with the comparison of rail access options.

6.1.3 ORGANIZATION

This chapter is divided into two major parts - the constraint mapping analysis and the comparative evaluation of rail access options. Within the constraint mapping section, an overview of the existing environment potentially affected by both steps is presented. Each of the two major parts of the chapter outlines the approach used to arrive at conclusions regarding preferred rail access including a description of scope and level of detail, data collection and analysis, study areas and assumptions. Factors are then identified, ranked and applied and conclusions are derived.

6.2 CONSTRAINT MAPPING

6.2.1 APPROACH

6.2.1.1 Options

Rail access opportunities were examined for all candidate sites. Rail service would only be provided to PI sites or to the PI portion of an integrated site. However, since decisions had not yet been made as to the placement of the physical/chemical treatment plant (i.e. with the landfill or with the incinerator), landfill sites such as LF-4N were considered.

6.2.1.2 Process

The constraint mapping procedure determined the potential for providing rail service to each of the candidate sites. It also identified, where desirable, rail access options to the candidate sites.

Figure 6.1 illustrates the process employed in the constraint mapping step. The first step in the process identified the factors for data collection and analysis purposes.

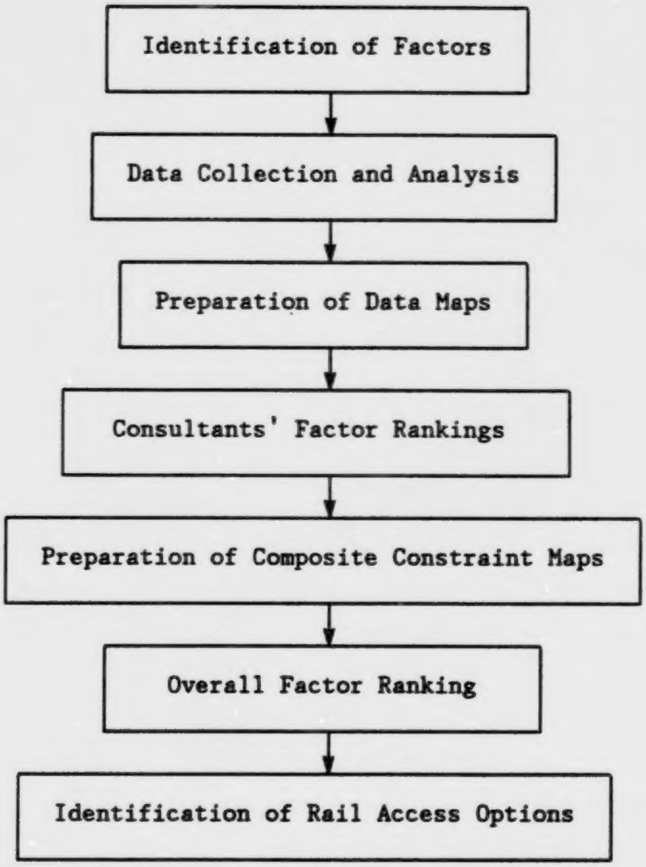
Each consultant collected data for their particular factors within the study area identified by the transportation consultant. The study area (referred to as the range limitations of service) extended from the nearest major rail line to each site and defined an area within which a rail line could potentially be established. The data were collected and mapped at a scale of 1:10,000.

The site selection consultants ranked their factors. The biology and surface water consultants described factor occurrences within this study area. The biology, agriculture and land use consultants assigned a level of constraint (or impact rating in the case of the agricultural consultant) from most to least constrained for each factor occurrence.

Data from all the consultants involved were synthesized by Dillon-Site Selection into a series of composite constraint maps. These maps were reviewed by the site selection team. An overall ranking of factors was developed by Dillon-Site Selection. The overall ranking recognized the two types of features involved in the constraint mapping procedure - features to be avoided and features for which the separation distance between the feature and rail line should be maximized. The factors were divided into these categories. They were also assigned a priority level of high, moderate or low.

Figure 6.1

Constraint Mapping Process


Identification of Factors
Data Collection and Analysis
Preparation of Data Maps
Consultants' Factor Rankings
Preparation of Composite Constraint Maps
Overall Factor Ranking
Identification of Rail Access Options

Rail access options into the candidate sites were identified from composite constraint maps.

6.2.1.3 Scope and Level of Detail

The constraint mapping analysis focused on the major considerations necessary to identify rail access options. The analysis was focused in the following ways:

- The consultants involved were M.M. Dillon-Transportation, Ecologistics Ltd., Gartner Lee Associates Ltd., Leon Kentridge Associates Ltd., the Institute of Environmental Research Inc. and Monenco Ltd. The analysis encompassed the major social, agricultural, land use, biological, transportation and engineering considerations potentially affected by the provision of rail access and suitable for use in a constraint mapping procedure.

- The constraint mapping analysis focused on the major potential risks, impacts and costs between the site and the existing main rail line. The regional system between the main rail line and the sources of additives and reagents was not considered in the analysis for the following reasons:

    i) the OWMC increment to current rail traffic would be very limited;

    ii) the degree of hazard associated with additives and reagents would be low as compared with both hazardous wastes and many of the hazardous chemicals currently carried on the rail system. The risk consultant, Environ Corp. suggested a weighting of 10 to 1 in comparing the risks of the two sets of materials;

iii) the sources of the additives and reagents could only be determined after detailed decisions and negotiations with sources;

iv) the routes by which source materials would be conveyed to the site would only be determined based on detailed discussions with the rail operators;

v) the major new direct impacts would be concentrated in the area between the existing main rail line and the site;

vi) rail access was at best an opportunity which might be provided at some point in the future. As such, a more detailed analysis of feasibility and desirability would be required if rail transport were considered in the future;

vii) any discussions with suppliers of additives and reagents or rail companies would be highly tentative. Conditions would change substantially between the present and the point at which the provision of rail access to the facility might be considered appropriate;

viii) the costs and time involved in including portions of the province-wide rail system in the analysis did not appear warranted in view of the limited contribution which such analysis would make to the identification and comparison of rail access options.

o The details of rail operations and transport costs were not considered. The major cost differences are reflected in construction costs. Differences in operation costs would be much more limited and would necessitate discussions with rail companies. Such discussions would also be highly tentative in view of the long lead time before rail access to the facility might be considered.

- The analysis of risk focused on receptors (e.g. number of people, recreation features within 250 m.) potentially at risk in the remote event of an accidental release. The actual level of risk associated with transportation, by rail, of additives and reagents is expected to be very low for the following reasons:

  i) rail service on the main rail line and spur line would be relatively light averaging 34 rail car movements per week during the tenth year of site operations when processing 300,000 tonnes/annum of special wastes. Operating speeds should be below 30 km per hour due to the relative shortness of the rail spur line connections. At this speed, and in the event of an accident, severity should be minimal;

  ii) rail-related accidents and spills involving dangerous goods are less frequent than road-related accidents;

  iii) the degree of hazard associated with additives and reagents is generally much less than that associated with untreated special wastes.

- The impact analysis focused on major off-site risks and impacts. On-site impact differences would contribute little to the analysis because there is considerable flexibility in the placement of the rail lines. The consultants also assumed complete site development. Thus, the addition of a rail spur line would not increase on-site impacts.

This level of detail was sufficient to identify the major considerations bearing on the identification of rail access options.

Rail access is not considered in the detailed comparative evaluation of siting options. As previously noted, rail access is not an essential element of facilities development. The effect of the provision of rail service upon the ranking of siting options, however, is examined in a sensitivity analysis in Chapter 8 (Volume 2).

6.2.1.4 Data Collection and Analysis

The data for the rail access analysis were derived largely from existing site and site vicinity investigations. Any additional analysis required outside the site vicinity was based on secondary sources and roadside field investigations.

The data collection process by the other site selection consultants included:

- Phase 3B data employed in the initial comparative evaluation of potential sites;
- a review of secondary source data;
- data collected for the site vicinity study area in the Phase 4A analysis;
- a review of Ministry of Revenue assessment roll maps (1:5,000);
- selective roadside field investigations;
- preliminary discussions with road and rail agencies.

Each consultant synthesized their data through the preparation of a constraint map at a scale of 1:10,000. The data maps were then provided to Dillon Site Selection who was responsible for assembling and synthesizing the other site selection consultants' data into composite constraint maps.

6.2.1.5 Facilities Characteristics Assumptions

The facilities characteristics assumptions employed in the Phase 4A rail analysis are listed in Table 6.1 together with an indication of their role.

TABLE 6.1

Facilities Characteristics Assumptions and Role in Analysis - Constraint Mapping

FACILITIES CHARACTERISTICS ASSUMPTIONS	ROLE IN ANALYSIS
° the initial OWMC treatment facility would be sized for treating 150,000 t/a of incoming waste and provision would be made for future expansion to 300,000 t/a	° affects estimates of wastes and additives to be transported
° all special waste is assumed to arrive by road transport only. The haulage of special wastes by rail was not considered. Bulk reagents and/or additives can be transported either by road or by rail	° implications for transportation analysis ° implications for impact assessment and level of detail of study
° rail service to a candidate site, where such service is desirable, is not viewed as a requirement but rather as an opportunity. The major benefit associated with the rail haulage of process additives and reagents would be a reduction in both road transport haulage and in the cost of transport of these materials to an integrated or partially integrated site. The lack of rail service to a site would not necessitate the rejection of the site	° provision of rail service has implications for overall impact assessment ° implications for transportation analysis

6.2.1.6 General Assumptions

The following general assumptions were used in the Phase 4A rail analysis:

- the construction of a rail spur line between a national rail line and the physical/chemical treatment plant located on a candidate site may necessitate acquisition of a new right-of-way. This would be a basic requirement at any candidate site which does not flank a national rail line right-of-way;

- the following were assumed in estimating the cost for each rail access option;

- installation of track (including grading and drainage):	$ 650/m
- connection to mainline track:	$130,000/option
- road crossing safety equipment:	$ 60,000/crossing

- for siting options where rail is feasible for the haulage of process additives and reagents, it is assumed that there is a 99% reduction in the number of trucks hauling additives and reagents; annual shipments by road would approximate 2,634 trucks. Annual shipments primarily by rail would involve approximately 969 rail cars and 35 trucks;

- where terrain is relatively flat to moderate rolling, a rail access right-of-way of some 50 to 60 feet would normally be adequate for a single track system including drainage ditches and fencing. A 60-foot (18.3 m) width was assumed in the rail analysis;

- rail car movements could occur any time during a 24-hour period, seven days a week. However, it was assumed that rail deliveries would be received only once or twice per week.

6.2.1.7 Determination of Rail Access Corridor

The transportation consultant, M.M. Dillon Ltd., identified the study area within which the constraint mapping analysis was undertaken.

The determination of the study area for rail service was largely dependent upon the preliminary design considerations for industrial spur lines, preliminary discussions with the road and railway agencies, and the safety of level road and rail crossings. The following were applied in selecting the preliminary geometrics of the rail lines:

- a 50 m minimum radius for curves;
- a number 8 type railway turn out connection to the rail mainline;
- preliminary discussions with railway agencies regarding the rail traffic along the mainline and possible shunting procedures near the site;
- preliminary discussions with road agencies regarding the possibility of introducing new level rail crossings on roadways near the site.

6.2.2 IDENTIFICATION OF FACTORS

The factor identification process began with the preliminary identification of factors by the site selection consultants. A composite list was developed by Dillon-Site Selection for consultant review, revision and subsequent application.

The factors used by the site selection team in the constraint mapping exercise are listed in Table 6.2. A rationale for these factors is provided in Table D.1 in Appendix D.

In the case of LF-2N and PI-13N, major impacts were associated with the provision of rail service. Maps 3 and 4 located at the back of this report illustrate the impacts. Before eliminating rail access as an opportunity at this stage of the analysis for these two sites, two additional transportation factors (construction cost and road crossings) were identified and applied. The initial list of factors provided the basis for the constraint mapping undertaken by the other site selection consultants.

6.2.3 EXISTING ENVIRONMENT

The following provides an overview of the existing environment under consideration for the rail access analysis:

(a) LF-4N

The site vicinity of LF-4N is rural in nature. These lands are designated mainly agricultural in regional and local official plans, with the balance of the area designated as Niagara Escarpment and Conservation and Hazard Lands. The area to the east of the site is intensively farmed. Cash crops including grain corn and small grains are the main crops grown. Canada Land Inventory Capability classes 1 and 3 are dominant in the area.

The site vicinity of LF-4N has approximately 130 residences and four commercial uses including a restaurant, a dog kennel, a carpentry business and a riding stable.

(b) PI-1N

The site vicinity of PI-1N is predominantly rural, but has over 100 residences and seven commercial uses. The hamlet of Boyne is situated at the north-east corner of the site, as defined by the Phase 3B acquisition boundaries. The site vicinity is designated almost entirely agricultural with some Parkway Belt uses.

The area to the west of the site is comprised of reasonably small land parcels. This area is not intensively farmed. Hay and pasture are the main agricultural uses. Soils are capability classes 1 and 3.

TABLE 6.2

Rail Access
Factors Used in Constraint Mapping

Transportation

- range of limitations for service
- construction cost (for LF-2N and PI-13N)
- road crossings (for LF-2N and PI-13N)

Biology

- significant environmental units (SEUs)
- non-SEU woodlots greater than 20 ha.

Surface Water

- number of stream crossings

Social/Land Use

- estimated population
- number and type of community and recreation features
- existing residences and clusters of residences
- existing commercial and industrial facilities
- residential land use designations

Agriculture

- proximity to farm buildings
- severance of farm parcels
- cropland

(c) PI-13N

The site vicinity of PI-13N is predominantly rural with approximately 170 residences, including a residential cluster along Britannia Road, and 14 commercial uses. Some of the commercial uses include tree farms, nurseries, riding stables and home businesses.

There are large areas of publicly-owned land to the north and east of the site. A golf course and a non-SEU woodlot greater than 20 ha are located to the west, between Derry Road and the site. Britannia and Derry Roads are the main roads crossed by a rail line, between the site and the main rail line.

The rail line would also cross a tributary of Sixteen Mile Creek. Sixteen Mile Creek has been designated as a significant environmental unit because it is a potential fish migration route. There are three major stream crossings and several minor stream crossings between the site and the rail line.

(d) LF-2N

The site vicinity of LF-2N is predominantly vacant. It does, however, have approximately 50 residences and several commercial uses including gas stations, restaurants, riding stables and fruit markets. Land use designations in the site vicinity include Agricultural and Parkway Belt.

Meadowvale Village is found to the west of LF-2N between the site and the main rail line. There are also a large number of small land parcels, SEUs 4-1 (Credit River) and 4-4 (Meadowvale Station Woods), a major crossing of the Credit River and floodplain and a crossing of the Fletcher's Creek floodplain between LF-2N and the main rail line.

(e) LF-3C

The site vicinity of LF-3C is actively farmed mainly with row crops, some hay and pasture. There are approximately 37 farms with headquarters in the vicinity of the site. Livestock raised in the vicinity include dairy cows, beef cattle, pigs, horses and poultry.

Although the site vicinity is predominantly rural, there are approximately 170 residences and four commercial uses.

The area located to the west of the site, between the site and the existing Toronto, Hamilton and Buffalo rail line is relatively small. The Elcho Church and Cemetery is, however, located in the north-east corner of the site. SEU 18-10 (Southwestern Elcho Forest) is located to the west of the main rail line. However, there is one small portion of the SEU which falls between the site and the rail line. There are several minor streams extending west of the site.

(f) LF-9C

There are approximately 75 residences and seven commercial facilities in the site vicinity. Commercial uses include restaurants, junk yards and home businesses. The site vicinity is zoned agricultural except for minor commercial uses and an unbuilt recreational trailer park.

The area to the east of LF-9C is actively farmed with a mix of corn, grain and hay with some pasture. Hay, corn and oats are the main crops grown to the north of the site. Livestock production in the site vicinity is high with beef cattle, dairy cattle, pigs and chickens being the main types of livestock raised. There are 29 farms with headquarters located in the site vicinity.

There are several minor stream crossings and small wetland areas located to the north of the site within the rail study area. To the east of the site there is one major stream crossing and several minor stream crossings. SEU 18-4 (Silverdale Woodlot) and SEU 18-8 (Davison's Bush) are found to the north and east of the site, respectively.

(g) LF-1E

The site vicinity of LF-1E is designated Good General Agricultural and Rural. At present, the area is predominantly rural, but has over 200 residences and nine commercial uses. The commercial uses include several automobile-related businesses and several home businesses.

There are 26 farm complexes with headquarters within the site vicinity. The land to the north of the site is cropped, mostly in hay and grain corn. To the west of the site, Class 3 soils are dominant and the land is idle or in low intensity crop uses.

Portions of SEU 19-2 (Horse Track Woodlot) are located to the north and west of LF-1E.

(h) PI-27E

The site vicinity of PI-27E is predominantly rural/agricultural with major heavy industrial uses to the north and west. The industrial uses include the Ford Glass Plant and Cyanamid. Land use designations in the site vicinity include Good General Agricultural, Industrial and Rural.

There are approximately 90 residences, six commercial uses and 11 industrial uses in the vicinity of PI-27E. The commercial uses include auto parts and home businesses.

6.2.4 RANKING OF FACTORS

6.2.4.1 Ranking of Factors - Individual Consultants

The factors used in the constraint mapping exercise are not all equal in importance. The site selection consultants, therefore, ranked their factors, where possible.

The basis for the ranking systems were the site selection goals and principles. The factors were ranked by the other site selection consultants in terms of the severity of potential risk to human health and potential environmental impact.

Table D.2 in Appendix D indicates the ranking of the factors as documented by the other site selection consultants and the rationale for those rankings. Further details regarding the ranking of rail access factors for constraint mapping are provided in the consultants' Phase 4A technical reports.

6.2.4.2 Overall Ranking of Factors[1]

An overall ranking of factors was derived to assist in the selection of rail access options. A moderate land use constraint, for example, is not necessarily equivalent to a moderate agricultural constraint. The identification and resolution of tradeoffs among factors is also an inherent component of the identification of rail access options.

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[1] A number of factors were not used in the overall ranking of factors. Range limitations for service had been defined by the transportation consultant, M.M. Dillon Ltd., and formed the study areas for the constraint mapping exercise. Construction costs and road crossings were examined for LF-2N and PI-13N only and were therefore not included in the overall ranking of factors. Estimated population was assumed to be covered by existing residence and clusters of residence and was therefore not included in the overall ranking.

There were two types of features involved in the constraint mapping exercise:

i. Those features that should be avoided, to the maximum extent possible; and

ii. Those features for which the separation distance between the feature and rail line should be maximized.

The constraint mapping procedure served to identify rail access options which minimized both displacement and disruption impacts. The factors were divided into those which should be avoided and those for which the separation distance should be maximized. Both sets of factors were assigned a level of priority - high, moderate or low. A high level of priority represented major potential risks or impacts. Where possible, these factors were considered exclusionary, i.e. a rail access option may not have been considered if there were occurrences of high priority factors. In some cases, complete avoidance was not possible. An attempt was made to maximize the separation distance between the feature and the rail line.

A moderate level of constraint represented moderate potential risks or impacts. It was important to avoid these potential impacts, where possible. When it was not possible to avoid these impacts, the potential displacement or interference of these features was minimized.

A low level of constraint avoided major potential risks and impacts.

Tables 6.3 and 6.4 provide the factor rankings by priority level and the rationale for the priority levels.

TABLE 6.3

Ranking of Factors - Features To Avoid

Priority Level	Factors	Rationale for Priority Level
° high	° clusters of residences	° line could result in displacement of residents ° alignments defined to avoid displacing residents
	° residential land use designations	° considered an incompatible land use with OWMC facility and/or rail line
	° community and recreation features	° construction of rail line could result in the displacement of community and recreation features ° alignments defined to avoid community and recreation features
	° SEUs	° splitting of an SEU by the rail line is expected to create an environmental impact through habitat fragmentation and displacement
	° severance of farm parcels - greater than 50 ha inefficient	° potential ongoing disruption to farm activities ° creation of small fields which are inefficient to farm with existing machinery and which restrict machinery access to fields
	° farm buildings - commercial farm buildings in average or above average condition	° construction of a rail line could result in displacement of farm buildings ° undesirable to displace commercial farm buildings with high investment
	° cropland - specialty crops	° specialty crops considered exclusionary; limited resource

TABLE 6.3

Ranking of Factors - Features To Avoid

Priority Level	Factors	Rationale for Priority Level
° high (cont'd)	° major stream crossings	° rail mishaps could result in environmental damage to surface water ° construction impacts associated with major stream crossings ° also desirable to avoid alignments which run along stream valleys
° moderate	° existing commercial and industrial facilities	° construction of a rail line could result in displacement of commercial and industrial facilities ° small uses involved; more readily re-located than homes or farms ° alignments defined to avoid commercial and industrial facilities
	° farm buildings - hobby or horse farms	° construction of a rail line could result in displacement of farm buildings ° generally less intensive agricultural operations associated with hobby or horse farms; lower impact potential
	° severance of farm parcels - 12-50 ha	° potential creation of small fields which are inefficient to farm with existing machinery and which restrict machinery access to fields
	° cropland - other cropland	° undesirable to remove land from crop production

TABLE 6.3

Ranking of Factors - Features To Avoid

Priority Level	Factors	Rationale for Priority Level
° moderate (cont'd)		° desirable to minimize cropped land crossed
	° non-SEU woodlots greater than 20 ha	° these areas have potential for providing habitat for woodland species ° desirable to avoid to the extent possible
	° minor stream crossings	° rail mishaps could result in environmental damage to surface water ° potential construction impacts ° also desirable to avoid alignments which run along stream valleys
° low	° cropland - not cropped	° lowest impact potential to land not cropped
	° farm buildings - below average (unused or derelict)	° construction of a rail line could result in displacement of farm buildings ° lower impacts to displace unused or derelict farm buildings than active farm buildings
	° severance of farm parcels - less than 12 ha	° greater preference to sever relatively small parcels than larger parcels

TABLE 6.4

Ranking of Factors - Maximization of Separation Distance

Priority Level	Factors	Rationale for Priority Level
° high	° residences and clusters of residences	° potential negative impacts from noise and general disruption associated with rail operations ° alignments defined to maximize distance between residences and rail line
	° community and recreation features	° potential negative impacts from noise and general disruption associated with rail operations
	° proximity to farm buildings - commercial farm buildings in average or above average condition	° number of barns in close proximity to the rail line indicates the potential risk to farm people, livestock and structures ° high impact to commercial farm operations
° moderate	° existing commercial and industrial facilities	° alignments defined to maximize distance between commercial and industrial facilities and rail line; noise less of a concern than with residential or community/recreation features
	° proximity to farm buildings - hobby or horse farms	° barns in close proximity to rail line indicates the potential for risk to farm people, livestock and structures ° lower impact than to commercial farm operations
	° SEUs	° SEUs may possess unique environmental attributes or perform significant environmental functions ° potential negative impacts from noise and general disruption associated with rail operations minimal

TABLE 6.4

Ranking of Factors - Maximization of Separation Distance

Priority Level	Factors	Rationale for Priority Level
° low	° proximity to farm buildings - below average (unused or derelict)	° potential risk to farm operations minimal or non-existent
	° non-SEU woodlots greater than 20 ha	° these areas have potential for providing habitat for woodland species ° potential negative impacts from noise and general disruption associated with rail operations minimal

distance between the feature and the rail line. Where a choice existed, higher priority was given to those factors ranked highest by the individual site selection consultants.

6.2.5 APPLICATION OF FACTORS

(a) LF-4N

Four rail access options were identified in the constraint mapping procedure for LF-4N. All options are spur lines which connect to an existing CNR line and enter the site from the eastern acquisition boundary. Figure 6.2 illustrates the options identified. The basis for the identification of each option is discussed below.

- Option 1 was identified as a possible rail access option for a preliminary engineering conceptual layout.[1] This option follows an existing property ownership boundary.

- Rail access Options 2 and 3 follow existing property ownership boundaries.

- Option 4 runs parallel to Britannia Road. It was identified as a possible option to provide access to the physical/chemical treatment plant from the south-east.

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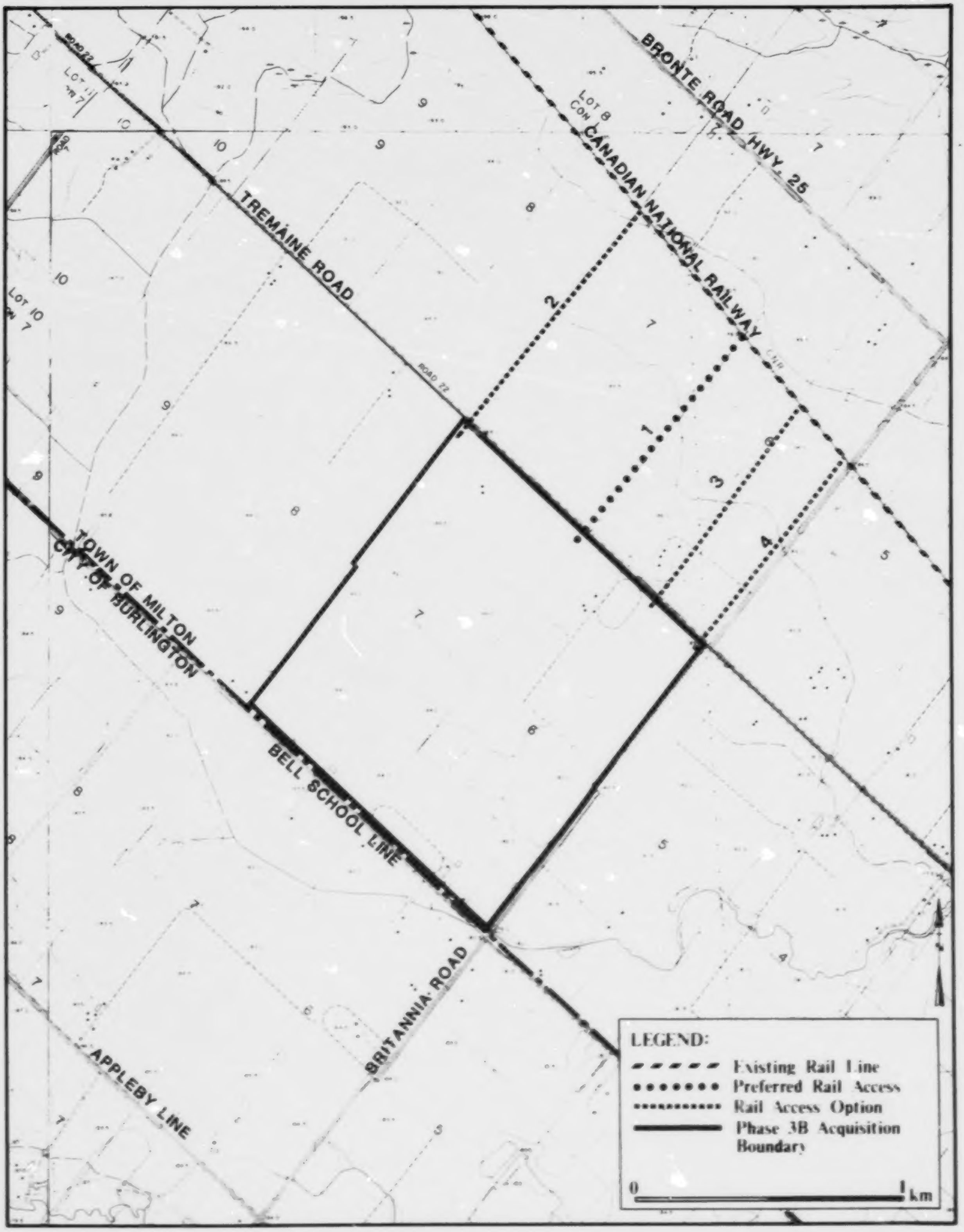
[1] The provision of rail service to the candidate sites was considered by the engineering consultant in the preparation of preliminary site layouts. These plans were prepared without any input from the other site selection consultants.


BRONTE ROAD HWY. 25
CANADIAN NATIONAL RAILWAY
TREMAINE ROAD
ROAD 22
TOWN OF MILTON
CITY OF BURLINGTON
BELL SCHOOL LINE
BRITANNIA ROAD
APPLEBY LINE
LOT 8 CON
LOT 10 CON 7
1
2
3
4
LEGEND:
Existing Rail Line
Preferred Rail Access
Rail Access Option
Phase 3B Acquisition Boundary
0
1 km

LF-4N RAIL ACCESS

FIGURE 6.2

(b) LF-2N[1]

No rail access options were identified through the constraint mapping procedure for LF-2N. LF-2N does not offer an opportunity for rail access. This conclusion is based on a review of major impacts and costs associated with the provision of rail service to this site. There are a number of constraints within the range limitation for service identified by the transportation consultant. These constraints include:

- The crossing of watercourses and a major floodplain (Credit River) and potential impacts on SEU 4-1 (Credit River Valley) and SEU 4-4 (Meadow Station Woods) were identified as constraints. Red-sided dace was identified as a rare species associated with Fletcher's Creek. The crossing of a major floodplain is associated with any rail option within the range limitation for service.

- Existing commercial and residential uses would be potentially displaced by a rail spur line. The land use and social consultants expressed a preference for locating a spur line within the southerly portion of the land. Proximity to Meadowvale was seen as a major constraint.

- Farm severances associated with the provision of rail service to this site were viewed as undesirable.

- Rail crossings of Third Line West, Second Line West, McLaughlin Road and Highway 10 (possibly requiring a grade separation) pose potentially significant transportation risks.

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[1] Siting options that included LF-2N were a part of the Phase 4A rail access evaluation. However, in May, 1985, OWMC dropped LF-2N from further consideration. The rationale for the dropping of LF-2N is summarized in Chapter 8 of this volume.

- An estimated construction cost of $12.7 million, excluding property acquisition costs, would be associated with providing rail service to the site.

The site selection team identified major impacts associated with the provision of rail service to LF-2N. The cost of providing such a service would also be significant. No matter where the rail line was placed within the study area there would be major impacts and costs. The major impacts and costs of providing rail service to LF-2N, therefore, outweigh the benefits associated with reduced truck volumes. Rail service does not represent an opportunity at LF-2N.

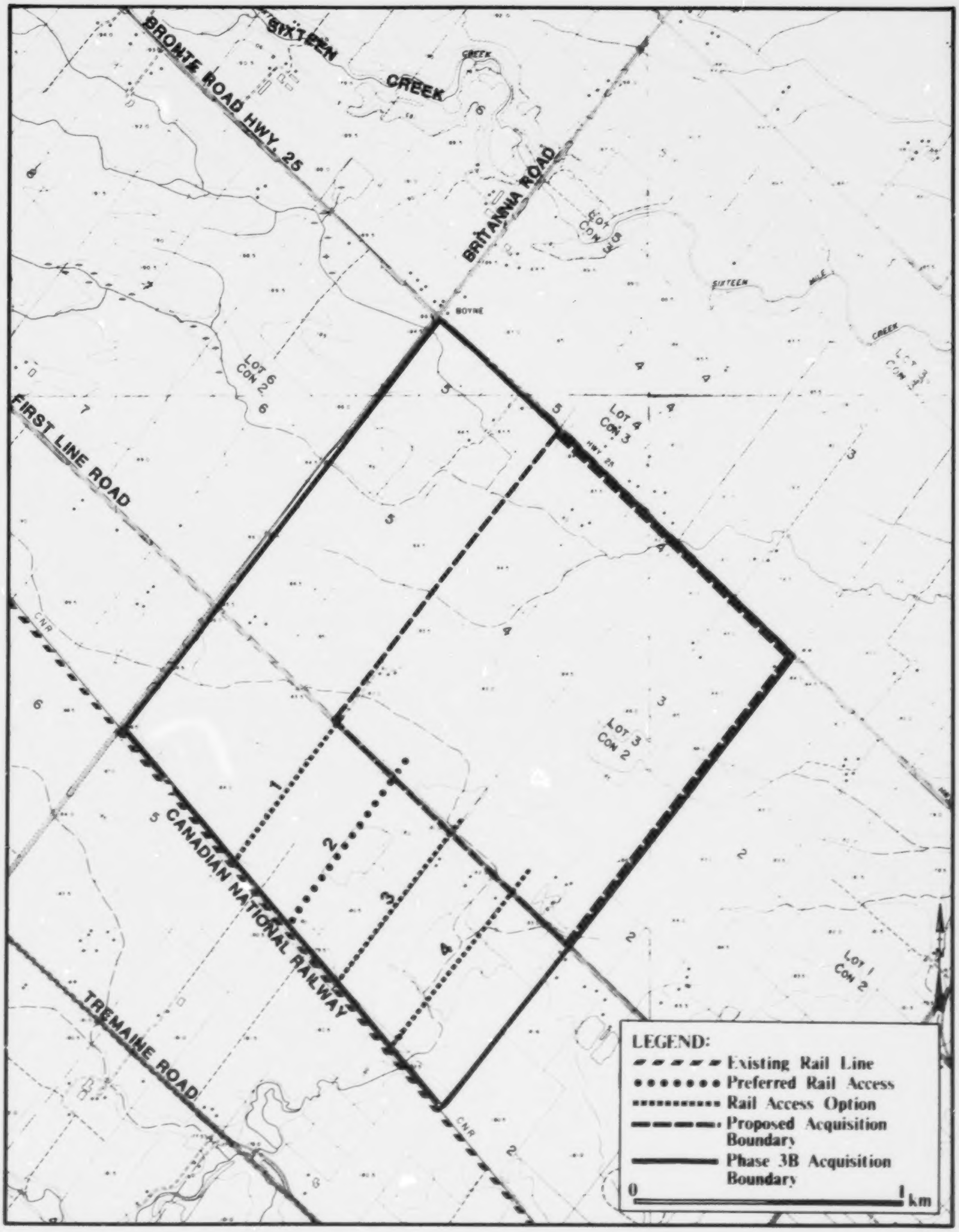
(c) PI-1N

Four rail access options were identified in the constraint mapping procedure for PI-1N. All options are spur lines which connect to an existing CNR line and enter the site from the western boundary. Figure 6.3 illustrates the options identified.

- all options follow existing property ownership boundaries;
- Options 1 and 2 avoid an existing farm complex and residences in close proximity to Options 3 and 4;
- Options 1, 2 and 3 also avoid a major stream crossing associated with Option 4.

(d) PI-13N

No rail access options were identified through the constraint mapping procedure for PI-13N. PI-13N does not offer an opportunity for rail access.


BRONTE ROAD HWY. 25
SIXTEEN CREEK
CREEK
BRITANNIA ROAD
BOYNE
SIXTEEN MILE CREEK
LOT 6 CON 2
LOT 4 CON 3
LOT 3 CON 2
LOT 1 CON 2
LOT 3 CON 3
LOT 5 CON 3
HWY. 25
FIRST LINE ROAD
CNR
CANADIAN NATIONAL RAILWAY
TREMAINE ROAD
1
2
3
4
5
6
7
LEGEND:
Existing Rail Line
Preferred Rail Access
Rail Access Option
Proposed Acquisition Boundary
Phase 3B Acquisition Boundary
0
1 km

PI-1N
RAIL ACCESS
FIGURE 6.3

This conclusion is based on a review of major impacts and costs associated with provision of rail to this site. A number of major constraints were identified by the site selection team within the range limitations for service identified by the transportation consultant. These constraints include:

- In the consideration of agricultural factors there was a preference for locating a spur line along the mid range of service to avoid a major nursery and to minimize severance of land ownership units.
- A golf course would be bisected by a rail spur line. There was a preference for locating a rail line in the western portion of the range of service from the social and land use perspectives.
- Biological constraints associated with the provision of rail service include major crossings of Sixteen Mile Creek and the severing of a non-SEU woodlot greater than 20 ha. Sixteen Mile Creek has been designated as significant from a fisheries point of view. There was a preference to locate a spur line within the western portion of the range of service to minimize major stream crossings.
- Two level rail crossings of Derry Road and Britannia Road are associated with rail service to PI-13N.
- An estimated construction cost of \$3.63 million, excluding land acquisition costs, would be associated with providing rail service to the site.

The site selection team identified major impacts associated with the provision of rail service to PI-13N. The cost of providing such a service would also be significant. No matter where the rail line was placed within the rail study area, there would be major impacts and costs. The major impacts and costs associated with the provision of rail service to PI-13N outweigh the benefits. Rail service, therefore, does not represent an opportunity at PI-13N.

(e) LF-3C

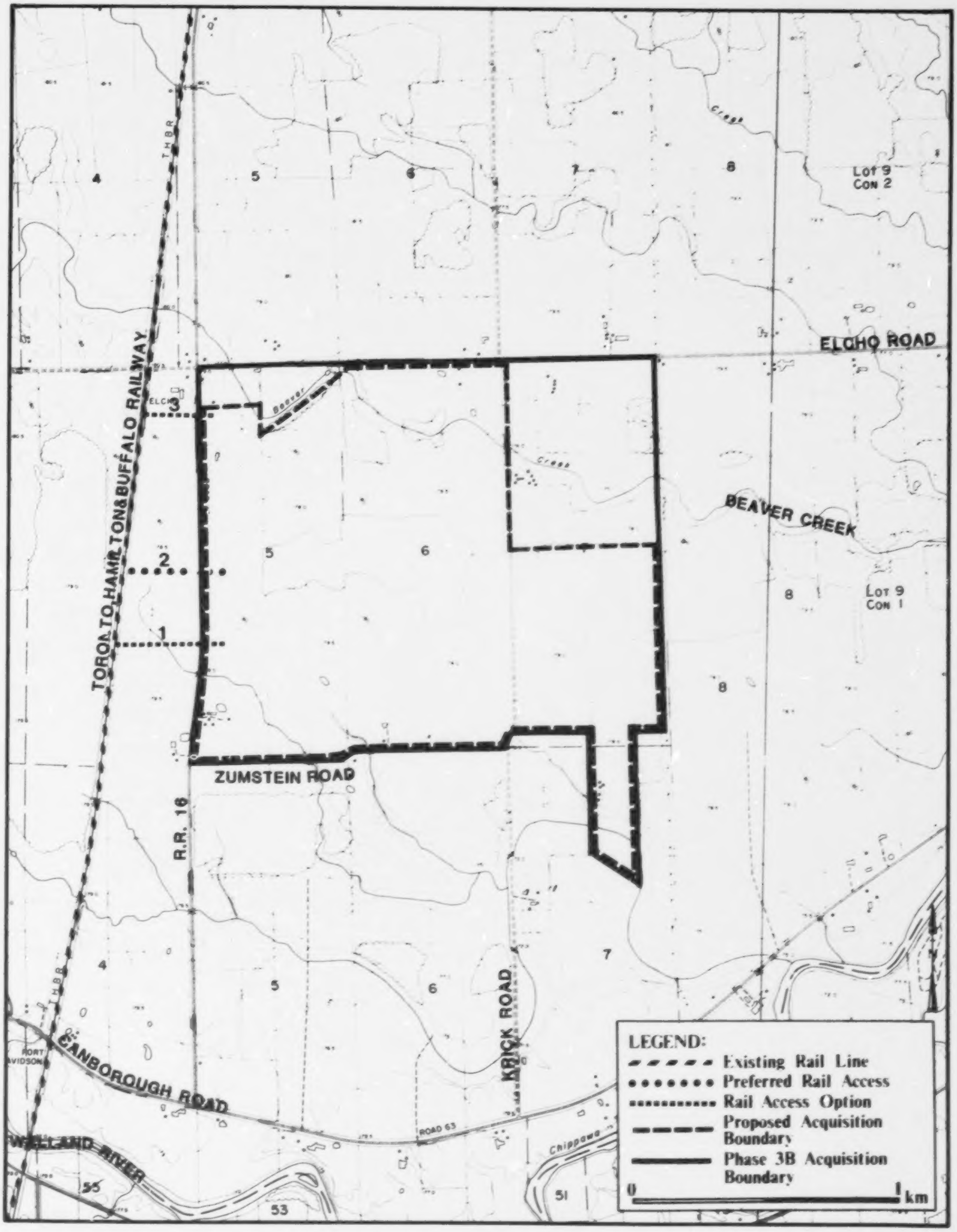
Three rail access options were identified in the constraint mapping procedure for LF-3C. All options are spur lines which connect to an existing Toronto, Hamilton and Buffalo line and enter the site from the western acquisition boundary. Figure 6.4 illustrates the options generated. The basis for the generation of each option is discussed below:

- Option 1 was generated by Monenco Ltd., as a possible rail access option for a preliminary conceptual layout. Option 1 passes through a small portion of SEU 18-10 (Southwestern Elcho Forest) at the point where the spur line joins the main rail line. A moderate constraint level is associated with the portion of SEU 18-10 severed by the existing main rail line.
- Option 2 coincides with an existing property ownership boundary. This option avoids SEU 18-10.
- Option 3 was generated to provide flexibility for the layout design refinements by providing rail access to the north portion of the site.

(f) LF-9C

Five rail access options were identified through the constraint mapping procedure for LF-9C. All options are spur lines connecting to an existing Toronto, Hamilton and Buffalo line. Figure 6.5 illustrates the options generated. The basis for the generation of each option is discussed below.

- Option 1 was generated by Monenco Ltd. as a possible rail access option for a preliminary conceptual layout. It was recognized that Option 1 crosses Sucker Creek and passes through SEU 18-8 (Davison's Bush).


TORONTO TO HAMILTON & BUFFALO RAILWAY
T.H.B.R.
ELCHO ROAD
BEAVER CREEK
Beaver
Creek
ZUMSTEIN ROAD
R.R. 16
KRICK ROAD
CANBOROUGH ROAD
ROAD 63
WELLAND RIVER
Chippawa
FORT DAVIDSON
Lot 9
Con 2
Lot 9
Con 1
4
5
6
7
8
1
2
3
55
53
51
LEGEND:
Existing Rail Line
Preferred Rail Access
Rail Access Option
Proposed Acquisition Boundary
Phase 3B Acquisition Boundary
0
1 km

LF-3C RAIL ACCESS

FIGURE 6.4

- Option 2 was selected as an alternative to Option 1 because it avoided SEU 18-8.

- Option 3 was generated as a means of providing access to the physical/chemical treatment plant from the south. This option runs parallel to Vaughan Road and is located north of any existing residences.

- Options 4 and 5 were selected as means of providing access to the site from the north. Both options follow existing property ownership lines.

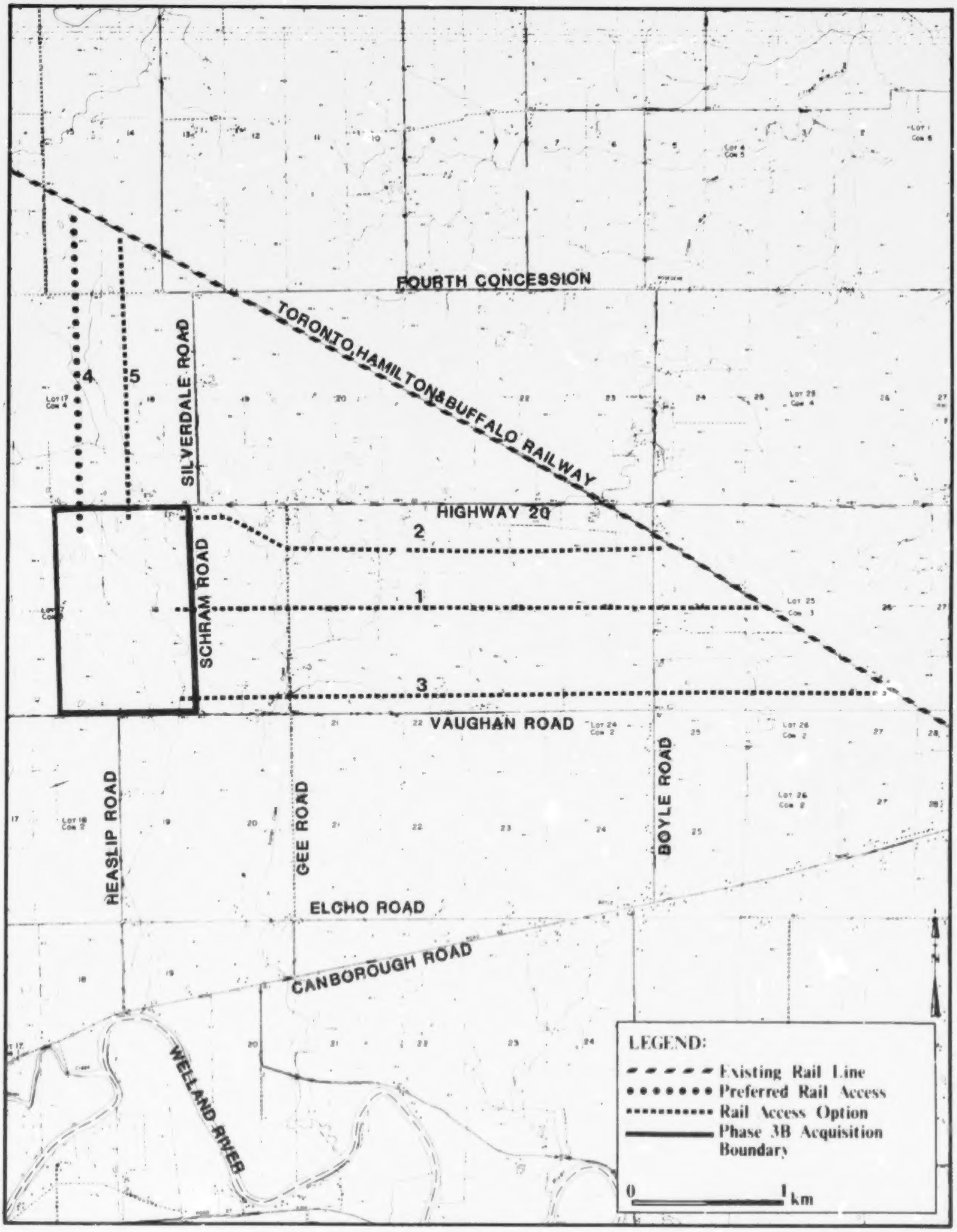
(g) LF-1E

Four rail access options were identified through the constraint mapping procedure for LF-1E. Three options are located on-site. Figure 6.6 illustrates the options generated. The basis for the generation of each option is discussed below:

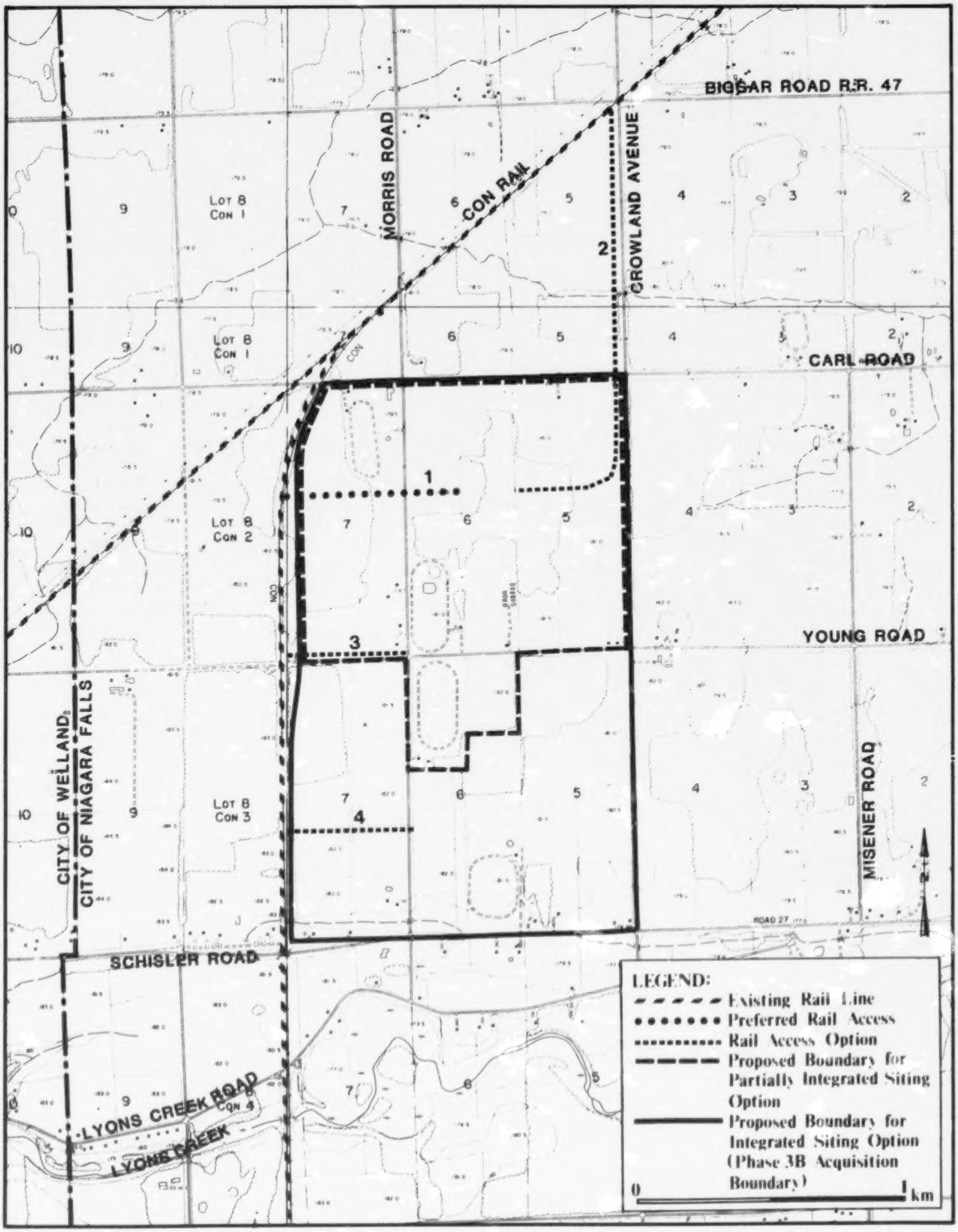
- Option 1 is an on-site spur line from an existing ConRail line running along the western acquisition boundary of LF-1E. It was generated by the engineering consultant as a potentially feasible rail access option for a preliminary conceptual layout. Option 1 passes through a small portion of a non-SEU woodlot greater than 20 ha between the site acquisition boundary and the main rail line.

- Option 2 was generated as a result of the desire to examine rail access from the north as an alternative. This option follows an existing property ownership boundary extending from the site acquisition boundary to the ConRail right-of-way. This alignment also avoids direct impact on SEU 19-2 (Horse Track Woodlot) located east of Option 2.

- Option 3 is an on-site spur line from the existing ConRail line. This option follows an existing property ownership boundary.


FOURTH CONCESSION
TORONTO HAMILTON & BUFFALO RAILWAY
SILVERDALE ROAD
4
5
HIGHWAY 20
2
1
3
SCHRAM ROAD
VAUGHAN ROAD
HEASLIP ROAD
GEE ROAD
BOYLE ROAD
ELCHO ROAD
CANBOROUGH ROAD
WELLAND RIVER
LEGEND:
Existing Rail Line
Preferred Rail Access
Rail Access Option
Phase 3B Acquisition Boundary
0
1 km

LF-9C
RAIL ACCESS
FIGURE 6.5


BIGGAR ROAD R.R. 47
MORRIS ROAD
CON RAIL
CROWLAND AVENUE
CARL ROAD
YOUNG ROAD
MISENER ROAD
SCHISLER ROAD
ROAD 27
LYONS CREEK ROAD
LYONS CREEK
CITY OF WELLAND
CITY OF NIAGARA FALLS
CON
Lot 8 Con 1
Lot 8 Con 1
Lot 8 Con 2
Lot 8 Con 3
Con 4
1
2
3
4
LEGEND:
Existing Rail Line
Preferred Rail Access
Rail Access Option
Proposed Boundary for Partially Integrated Siting Option
Proposed Boundary for Integrated Siting Option (Phase 3B Acquisition Boundary)
0
1 km

LF-1E
RAIL ACCESS
FIGURE 6.6

- o Option 4 is an on-site spur line from the existing ConRail line. The option was generated by Monenco Ltd., as a potential rail access option for a second preliminary conceptual layout for an integrated facility.

(h) PI-27E

An existing ConRail line runs diagonally through PI-27E (Figure 6.7). The site selection consultants determined that rail access to this site does not present any off-site impacts. The engineering consultant then determined that a spur line from the existing ConRail line would be feasible in terms of the facility layout for this site. No on-site impacts, with the exception of cost, were identified with this site. An on-site spurline should be retained for the provision of rail service to PI-27E.

6.2.6 CONCLUSIONS

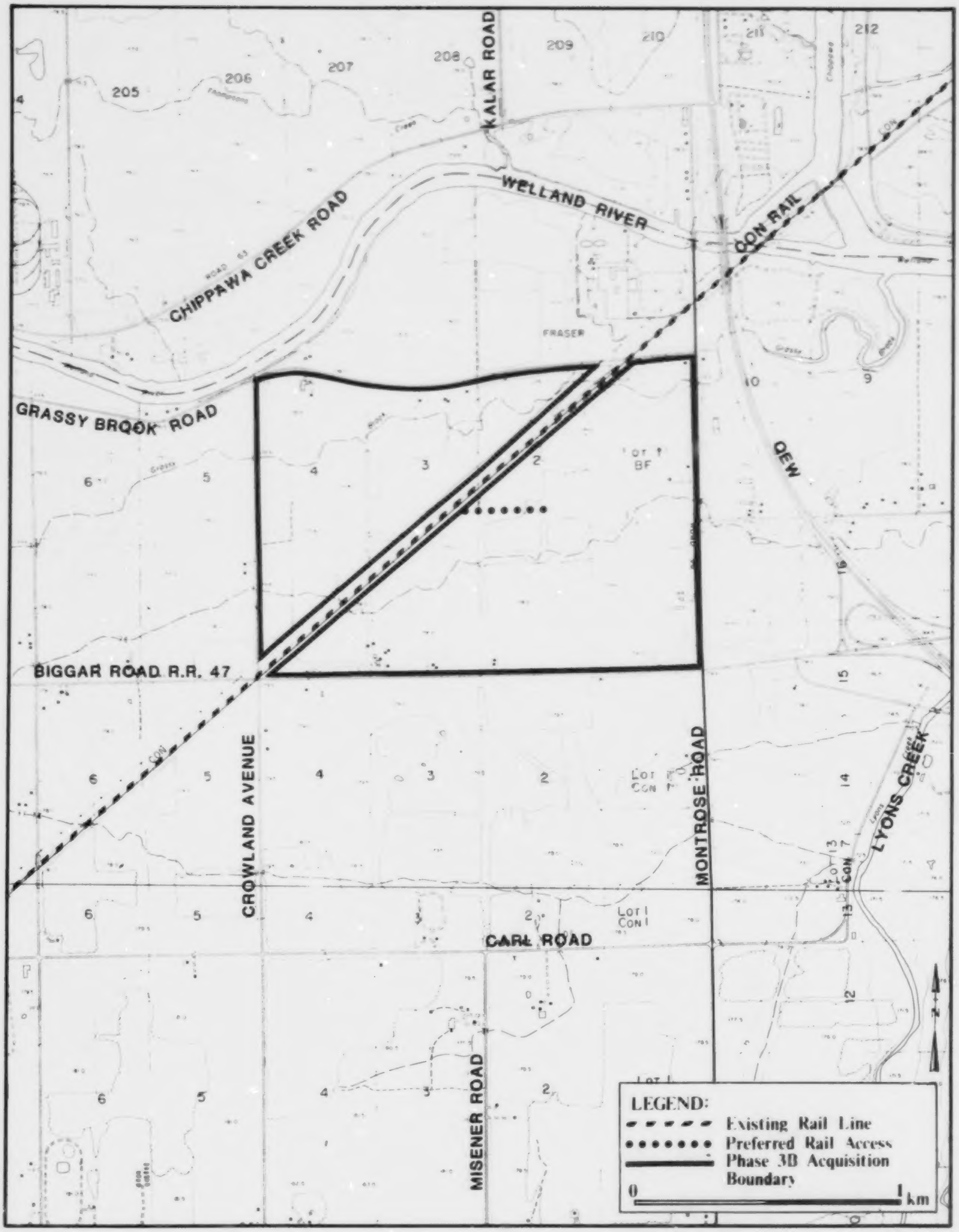
Rail access options were identified for candidate sites LF-4N, PI-1N, LF-3C. LF-9C, LF-1E and PI-27E. Rail service is not an opportunity at candidate sites LF-2N and PI-13N.

6.3 COMPARATIVE EVALUATION OF RAIL ACCESS OPTIONS

6.3.1 APPROACH

6.3.1.1 Options

The comparative evaluation of rail access options compared the options identified in the constraint mapping stage and selected a preferred rail access option.


205
206
207
208
209
210
211
212
KALAR ROAD
WELLAND RIVER
CHIPPAWA CREEK ROAD
CON RAIL
FRASER
GRASSY BROOK ROAD
QEW
6
5
4
3
2
LOT 1
BF
10
9
16
BIGGAR ROAD R.R. 47
15
CON
CROWLAND AVENUE
MONTROSE ROAD
LOT 1
CON 1
14
LYONS CREEK
13
CON 7
Lot I
Con I
CARL ROAD
12
MISENER ROAD
LEGEND:
Existing Rail Line
Preferred Rail Access
Phase 3B Acquisition Boundary
0
1 km

PI-27E
RAIL ACCESS
FIGURE 6.7

6.3.1.2 Process

Figure 6.8 illustrates the process employed in the comparative evaluation of rail access options. The first step in the process involved the identification of factors for data collection and analysis purposes. Each consultant collected data for each option. They also prepared constraint maps at a scale of 1:10,000 and summary data tables. The site selection consultants then ranked their factors.

A series of composite maps and data tables were prepared by Dillon-Site Selection.

An overall ranking of factors was devised by Dillon-Site Selection. As with constraint mapping, the overall factor ranking recognized those features that should be avoided and those features for which the separation distance between the feature and rail line should be maximized. The factors were divided into these categories. They were also assigned a priority level of high, moderate or low.

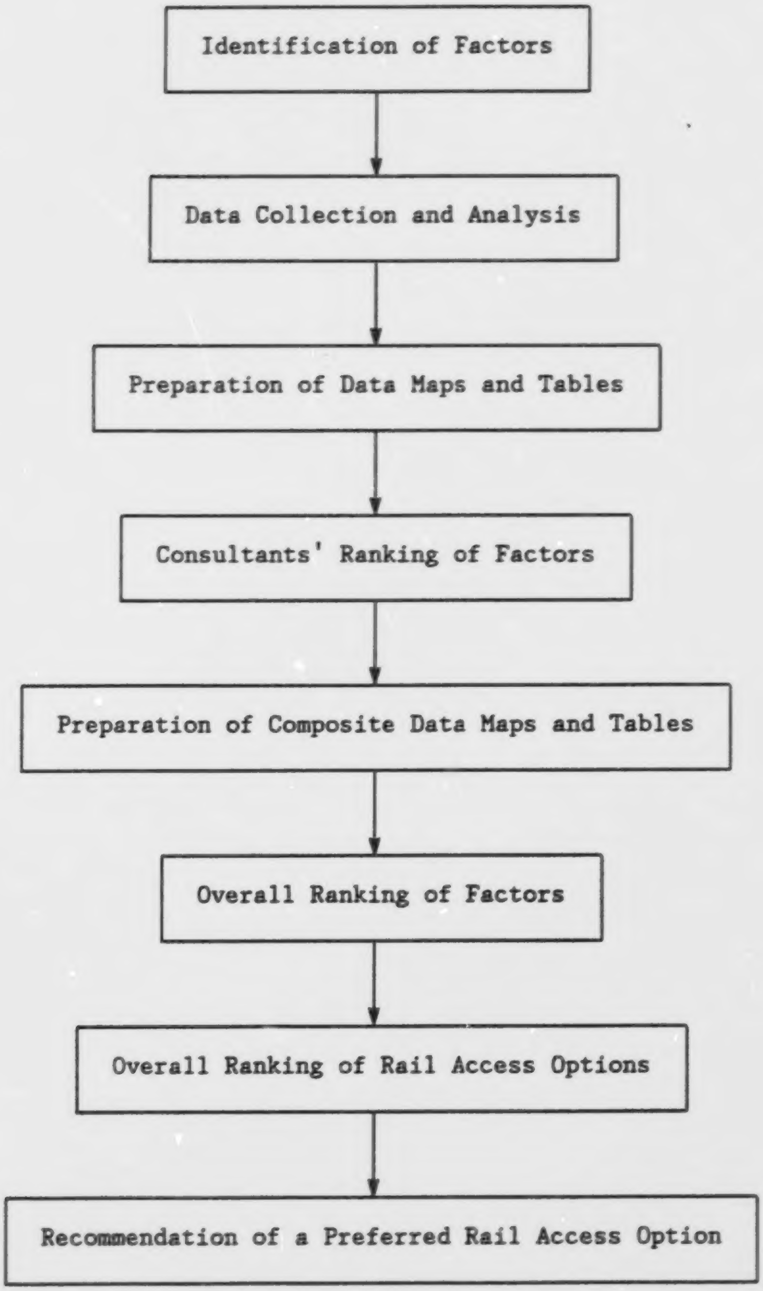
The factor application process began with a review of the relative differences among the rail access options by the site selection team. These differences are highlighted in Table D.3 in Appendix D.

Rail access options were ranked in order of preference from most to least preferred based on a review of these differences, and the factor rankings. A rationale for the ranking was provided. Where there were no differences or minor differences between or among rail access options, the options were ranked at the same level.

The comparative evaluation process focused on the major issues associated with each option and the major tradeoffs among the rail access options. A reasoned argument, based upon the overall ranking of factors, was formulated to substantiate the ranking of options for each candidate site. A preferred rail access option was recommended to OWMC.

FIGURE 6.8

Process Employed in Comparative Evaluation of Rail Access Options


Identification of Factors
Data Collection and Analysis
Preparation of Data Maps and Tables
Consultants' Ranking of Factors
Preparation of Composite Data Maps and Tables
Overall Ranking of Factors
Overall Ranking of Rail Access Options
Recommendation of a Preferred Rail Access Option

6.3.1.3 Scope and Level of Detail

The comparative evaluation of rail options to each site was conducted after the constraint mapping exercise identified specific rail access options. The analysis was conducted at a scale of 1:10,000. The analysis involved the collection of data within the 170 m and 250 m impact zones*. As with the constraint mapping, the comparative evaluation focused on direct impacts on major features and resources. For the same reasons detailed in Section 6.2.1.3, the comparative evaluation process:

- addressed major social, agricultural, land use, biological, transportation and engineering considerations;

- focused on the major potential risks, impacts and costs between the site and the existing rail system;

- did not consider the details of rail operations and transport;

- did not consider on-site risks and impacts.

The level of detail was sufficient to identify the major considerations bearing on the identification of rail access options between each site and the existing main rail line. The rationale for the 170 m and 250 m study areas is provided in Section 6.3.1.5.

6.3.1.4 Data Collection and Analysis

The data for the comparative evaluation of rail access options were largely derived from existing site and site vicinity investigations. Any additional analysis required outside the site vicinity was based on secondary sources and roadside field investigations.

The data collection process by the other site selection consultants included:

- data collected for the site vicinity study area in the Phase 4A analysis;
- roadside field investigations;
- reviews of secondary source data (e.g. C.L.I. capability mapping, Land Use Systems mapping);
- air photos at a scale of 1:10,000;
- discussions with road and rail authorities.

The data were collected and synthesized by the site selection consultants into a series of working maps at a scale of 1:10,000 and matrices. Dillon-Site Selection was responsible for the preparation of composite matrices and working maps. The composite matrices are provided in Table D.3 in Appendix D.

6.3.1.5 Identification of Rail Analysis Impact Zones

(a) Introduction

Impact zones of 170 m and 250 m were identified for the comparative evaluation of rail access options.

The 170 m impact zone represents the area flanking each side of a rail spur line within which the maximum noise impacts could be expected to occur. The 250 m impact zone is based on a Transport Canada study on the Mississauga train derailment. This zone was identified as the area flanking each side of a rail line beyond which the impact of short range catastrophic events such as explosions or fires could be expected to be minimal. The following documents the basis of these impact zones as developed by the transportation consultant, M.M. Dillon Ltd.

(b) 170 m Impact Zone

It was necessary to consider rail service noise generation to assess the impacts of the proposed rail spur line connection from the main rail line into a candidate site. No consideration was given to rail noise level change on the main line since the additional rail car traffic generated by OWMC is small.

Rail shipments can be expected to average 6.7 rail car loadings per day or 34 cars per week based upon the quantities of process additives and reagents required at an integrated site or at a separate physical/chemical treatment plant site[1].

A preliminary rail noise analysis was conducted by the noise consultant, S.S. Wilson Associates Ltd., for three possible rail car shipment sizes and assuming an operating speed of 32 km/hour (20 mph), as follows:

- delivery of seven rail car loads/day with one locomotive;
- delivery of 17 rail car loads with one locomotive every 2,5 days; or
- delivery of 34 rail car loads/week with two locomotives.

The duration of each train passing by any point along the spur line was calculated for each case. This was determined to range from 0.27 minutes to 1.23 minutes. For each of the operating conditions, the peak noise level and eight hour Leq dBA value was calculated for receptors located from 30 to 1300 m away from the rail spur line. The increments of lateral distance used were 30, 60, 100, 110, 130, 170, 200, 300, 400, 500, 600, 700, 800 and 1300 metres, but varied for rail operating conditions examined.

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[1] Based upon the tenth year of operation and 300,000 tonnes per annum of special wastes.

Based upon available ambient noise level data the level for rural areas would usually be from 35 to 40 dBA and for suburban areas from 45 to 50 dBA. An average threshold value of 45 dBA Leq (eight hours) was therefore assumed as the probable limit of noise annoyance when the peak passby level is below 75 dBA.

When these values were compared to the worst case calculations (identified as 34 rail cars, two locomotives and a passby duration of 1.23 minutes), the corridor width of 170 m each side of the rail spur line was defined as the primary impact area. This value was provided to other consultants for evaluation purposes.

The noise corridor definition described above is approximate in nature. It is based on the assumption that the rail spur line profile is approximately at ground level and that the adjoining terrain within the corridor is relatively flat. When other conditions prevail, such as an elevated rail line profile, the noise corridor would be more extensive. Conversely, if the rail line is depressed and the adjoining ground elevations are higher, the width of the affected noise corridor would be less. However, the approach used was adequate for comparative evaluation purposes.

(c) 250 m Impact Zone

It is also important to consider the implications of rail spillage or risk in the definition of impact zones. The transportation consultant, M.M. Dillon Ltd., undertook a preliminary literature review. In a study undertaken after the Mississauga train derailment, Transport Canada identified an impact zone of 250 m[1] beyond which it can be assumed that, "the impact of short-range events (explosions and fires) are less likely to have a major impact".

Since rail transport was being considered for only the shipment of additives and reagents (i.e. no special waste is to be transported by rail), the 250 m impact zone was adequate for comparative evaluation purposes.

6.3.1.6 Facilities Characteristics Assumptions

The facilities characteristics assumptions employed in the Phase 4A rail analysis are listed in Table 6.5 together with an indication of their role in the analysis.

6.3.1.7 General Assumptions

The general assumptions governing the Phase 4A constraint mapping analysis (Section 6.2.1.6) also applied to the comparison of rail access options.

6.3.2 IDENTIFICATION OF FACTORS

The factor identification process began with a preliminary identification of possible factors and indicators by the site selection consultants. A composite list was prepared by Dillon-Site Selection for consultant review, revisions and subsequent application.

The factors used by the site selection team in the comparative evaluation of rail access options are listed in Table 6.6. A rationale for these factors is provided in Table D.4 in Appendix D.

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[1] Canada Transport Commission, Railway Committee (1983). The Transport of Dangerous Commodities by Rail in the Toronto Census Metropolitan Area: A Preliminary Assessment of Risk. Prepared by I. Burton and K. Post, p.61.

TABLE 6.5

Facilities Characteristics Assumptions and Role in Analysis - Comparative Evaluation of Options

FACILITIES CHARACTERISTICS ASSUMPTIONS	ROLE IN ANALYSIS
° the initial OWMC treatment facility would be sized for treating 150,000 t/a of incoming waste and provision would be made for future expansion to 300,000 t/a	° affects estimates of wastes and additives to be transported
° two impact zones of 170 m (noise) and 250 m (risk) along each side of rail access options were used for the rail access analysis. Impacts due to rail traffic accidents are not expected to be significant beyond 250 m from the rail line	° zones used for impact prediction ° employed in social, land use and agriculture analysis
° all special waste is assumed to arrive by road transport only. The haulage of special wastes by rail was not considered. Shipment of bulk reagents and/or additives can be assumed to arrive by road or by rail	° implications for transportation analysis ° implications for impact assessment and level of detail of study
° rail service to a candidate site, where such service is desirable, is not viewed as a requirement but rather as an opportunity. The major benefit associated with the rail haulage of process additives and reagents would be a reduction in both road transport haulage and in the cost of transport of these materials to an integrated or partially integrated site. The lack of rail service to a site would not necessitate the rejection of the site	° provision of rail service has implications for overall impact assessment ° implications for transportation analysis

TABLE 6.6

Rail Access

Factors Used in Comparative Evaluation of Options

FACTOR GROUPING	FACTOR
A. **RISK**	
° **Transportation**	° number and type of roads crossed (local, regional, provincial highways) ° intersection/rail crossing separation distance (m)
° **Hydrogeology**	° distance through hydrogeologically sensitive lands
° **Surface Water Suitability**	° number of stream crossings ° number of floodplains, flood-prone areas and wetlands
B. **ENVIRONMENTAL IMPACTS**	
° **Residents**	° displacement of residents[1] ° disruption of day-to-day activities and/or the use and enjoyment of property
° **Community and Recreation Features**	° displacement of community and recreation features ° disruption of operations of community and recreation features

---

[1] A "Number of Residences" factor was employed by the land use consultant, Leon Kentridge Associates Ltd. Although the factor was necessary for an overall land use perspective and facilitated study team discussion, it has not been included in the comparative evaluation as it would represent double counting.

TABLE 6.6

Rail Access

Factors Used in Comparative Evaluation of Options

FACTOR GROUPING	FACTOR
B. **ENVIRONMENTAL IMPACTS**	
° Land Use	° number and type of commercial facilities
° Agricultural Resources	° proximity to farm buildings (number of building complexes) (within 500 m zone) ° severance of farm parcels (number and severity) ° amount of cropland affected (within 500 m zone) (ha) ° loss of farmland (Class 1 equivalents) (ha)
° Natural Environment	° rare species ° fish and wildlife features of significance ° significant environmental units (SEUs) ° non-SEU woodlots greater than 20 ha
C. **ENGINEERING COST**	
° Cost[1]	° cost of rail infrastructure from mainline to plant ° off-site land acquisition required
° Flexibility	° site size ° landfill life ° off-site features

[1] Developed and employed by M.M. Dillon-Transportation.

6.3.3 RANKING OF FACTORS

6.3.3.1 Introduction

The evaluation procedures employed by the site selection consultants varied considerably. At a minimum, the consultants ranked their factors and the rail access options. They also provided a rationale for each step. The scaling of data, based on the distribution of options under consideration, and the application of factor weights were additional evaluation steps that could be undertaken. Where possible, the difference between the options was also noted. Each consultant developed and adapted an evaluation procedure appropriate to their factors and the nature of their data base.

In some cases, for example with the hydrogeologic analysis, there was only one factor and only one occurrence of the factor. In these cases, the evaluation procedures consisted solely of a ranking of rail access options.

6.3.3.2 Ranking of Factors - Individual Consultants

The factors employed in the comparative evaluation of rail access options are not equal in importance. The site selection consultants therefore ranked their factors.

The basis for the ranking systems developed were the site selection goals and principles. The factors were ranked by the other site selection consultants in terms of relative severity of risk to human health and potential environmental impact.

Table D.5 in Appendix D indicates the ranking of factors of the other site selection consultants and the rationale for the ranking. Further details regarding the ranking of rail access factors for the comparative evaluation of rail access options are provided in the consultants' Phase 4A technical reports.

6.3.3.3 Overall Ranking of Factors

The comparative evaluation of rail access options was basically an extension and elaboration of the constraint mapping exercise. Essentially, the same factors were used for both constraint mapping and the comparative evaluation. Modifications to factors were the result of the following:

- the factor was not required since all factor occurrences had been eliminated in constraint mapping;
- it was possible to examine some additional factors since specific options had been identified;
- it was possible to provide a finer breakdown of some factors due to an increased level of detail.

Table D.6 in Appendix D provides a comparison of constraint mapping and comparative evaluation factors.

The overall ranking of factors was also viewed to be largely an extension of the overall ranking employed in constraint mapping. In the rail access option comparison, however, the transportation factor intersection/rail crossing separation distance (m) was treated as exclusionary. This factor ensures a measure of safety for level rail crossings. The Ontario Ministry of Transportation and Communications (MTC) specifies that for roads with a posted speed of 80 km/hr. that 180 to 240 m is the adequate warning distance for level railway crossings. This separation distance ensures that vehicles turning on to a road will have adequate sight and stopping distance before the rail crossing. Options failing to meet this guideline were excluded. After the application of this rail safety guideline, the remaining factors were ranked and applied.

Factors were ranked because a moderate land use constraint, for example, would not necessarily be equivalent to a moderate agricultural constraint. The identification and resolution of tradeoffs among factors is also an inherent component of the identification of rail access options.

There were basically two types of features represented by the comparative evaluation factors:

i. those features that should be avoided, to the maximum extent possible; and

ii. those features for which the separation distance between the feature and rail line should be maximized.

The comparative evaluation identified a preferred rail access option that minimized both environmental impacts and disruption to environmental features. The factors were therefore divided into those which should be avoided and those for which the separation distance should be maximized. Both sets of factors were assigned a level of priority - high, moderate or low.

A high priority level represented major potential risks or impacts. Where possible, these factors were considered exclusionary. In some cases, complete avoidance was not possible. An attempt was made to maximize the separation distance between the feature and the rail line.

A moderate level of constraint represented factors that had moderate potential risks or impacts. These factor occurrences were avoided, where possible. When it was not possible to avoid these factor occurrences, the potential displacement of or interference with these features was minimized.

A low level of constraint avoided major potential risks and impacts.

TABLE 6.7

Ranking of Factors - Features to Avoid

Priority Level	Factors	Rationale for Priority Level
° high	° displacement of residents	° construction of a rail line could result in displacement of residents ° those alignments which avoid residences preferred
	° displacement of community and recreation features	° construction of rail line could result in displacement of community and recreation features ° those alignments which avoid community and recreation features preferred
	° severance of farm parcels	° an on-going disruption to farm activities ° creation of small fields which are inefficient to farm with existing machinery and which restrict machinery access to fields, if crossings are not provided
	° farm buildings	° construction of a rail line could result in displacement of farm buildings
	° amount of cropland affected	° provides a measure of risk to standing crops due to rail mishaps ° desirable to minimize cropland crossed
	° loss of farmland	° construction of rail line could result in transfer of land for agriculture to non-agricultural uses ° impacts will be less for options with lowest Class 1 equivalent rating
	° SEUs	° splitting an SEU by the rail line is expected to create an environmental impact through habitat fragmentation and displacement

TABLE 6.7

Ranking of Factors - Features to Avoid

Priority Level	Factors	Rationale for Priority Level
° high (cont'd)	° major stream crossings	° rail mishaps could result in environmental damage to surface water ° construction impacts associated with major stream crossings
	° number of floodplains, flood-prone areas and wetlands	° these land are subject to periodic flooding
	° number of floodplains, flood-prone areas and wetlands	° evidence of wet surface conditions or poor drainage ° no rail line should be located on these lands
° moderate	° number and type of commercial facilities	° construction of a rail line could result in displacement of small commercial facilities; small businesses generally more readily relocated than houses or farms ° preference given to those alignments with avoided commercial facilities
	° minor stream crossings	° rail mishaps could result in environmental damage to surface water ° also desirable to avoid alignments which run along stream valleys
	° non-SEU woodlots greater than 20 ha	° these areas have potential for providing habitat for woodland species ° desirable to avoid to the extent possible
	° fish and wildlife features of significance	° natural features of significance may be eliminated or fragmented by the construction of rail line ° desirable to avoid to the extent possible

TABLE 6.7

Ranking of Factors - Features to Avoid

Priority Level	Factors	Rationale for Priority Level
° moderate (cont'd)	° rare species	° assumed that the more rare species encountered, the higher the probability of creating an environmental impact
	° number and type of roads crossed	° transportation safety along roadways near the candidate sites may be affected by the introduction of level railway crossings ° impact of such conflicts considered potentially mitigable
° low	° distance through hydrogeologically sensitive lands	° anticipated that spills will be cleaned up promptly ° only 1 factor occurrence

TABLE 6.8

Ranking of Factors - Maximization of Separation Distance

Priority Level	Factors	Rationale for Priority Level
° high	° disruption of day-to-day activities and/or the use and enjoyment of property	° potential negative impacts from noise and general disruption associated with rail operations ° preference given to those alignments maximizing distance between residences and rail line
	° disruption of operations of community and recreation features	° potential negative impacts from noise and general disruption associated with rail operations
	° proximity to farm buildings	° assumed that all actively used barns were used for livestock housing ° number of barns adjacent to rail line indicates the potential for disruption to livestock
° moderate	° number and type of commercial facilities	° preference given to those alignments which maximize distance between commercial facilities and rail line
	° SEUs	° SEUs may possess unique environmental attributes or perform significant environmental functions ° potential negative impacts from noise and general disruption associated with rail operations minimal
° low	° non-SEU woodlots greater than 20 ha	° these areas have potential for providing habitat for woodland species ° potential negative impacts from noise and general disruption associated with rail operations minimal
	° fish and wildlife features of significance	° potential negative impacts from noise and general disruption associated with rail operations minimal

Tables 6.7 and 6.8 rank the factors by priority level and provide a rationale for the priority levels.

The transportation factors off-site land acquisition required and cost of rail infrastructure from mainline to plant and the engineering factors, site size, landfill life and off-site features - were all assigned a low priority level.

6.3.4 APPLICATION OF FACTORS

(a) LF-4N

Four rail access options were identified for LF-4N. These options are illustrated on Figure 6.2.

Option 1 should be retained as the preferred rail access for LF-4N. The main reasons for this conclusion include the following:

- The transportation consultant concluded that Option 4 is unacceptable from a transportation risk point of view[1]. The intersection/rail crossing separation is less than 180 m minimum required by the Ontario Ministry of Transportation and Communications (MTC) for signing at-grade rail crossings. A 240 m or more separation distance between a road intersection and rail crossing is desirable from a safety perspective. A separation distance of 180 m or less is unacceptable.

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[1] The transportation factor dealing with intersection/rail crossing separation (site distance between an intersection and a railway crossing) was a mandatory requirement for all rail access options. Any options which did not meet this basic criterion were eliminated from further consideration.

- Options 1, 2 and 3 are equal for transportation safety. Option 3 is preferred from a cost perspective.

- Options 3 and 4 have one minor stream crossing. Options 1 and 2 have one additional minor stream crossing.

- Option 3 requires less off-site land acquisition than Option 2. Option 3 also has a lower associated cost. From a socio-economic/land use perspective, Option 2 is ranked higher than Option 3. There are four residents within 170 m impact zone with Option 3.

There are no appreciable differences between the options based on agricultural or engineering considerations.

- Option 1 is ranked higher than Option 3 because it impacts fewer residences, avoids a farm building complex and minimizes interference with the landfill area. It also minimizes the length of the rail spur line.

The overall ranking of rail access options and the rationale for the ranking is provided in Table 6.9. Based on the above analysis, Options 2, 3 and 4 should be eliminated. Option 1 should be retained as the preferred rail access option for LF-4N.

(b) PI-1N

Four rail access options were identified for PI-1N. These options are illustrated in Figure 6.3.

Option 2 should be retained as the preferred rail access for PI-1N. The main reasons for this conclusion include the following:

TABLE 6.9

Overall Ranking of Rail Access Options

LF-4N

OPTION	RANKING	RATIONALE FOR RANKING
1	1	° No social or land use impacts ° Options 1, 2 and 3 equal in terms of transportation safety; ranking based on differences in cost ° Minimum rail spur line required
2	2	° No social or land use impacts ° No farm severances or farm complexes close to option ° Negative impact on sizing and configuration of operating area and landfill cells
3	3	° 4 residents within 170 m impact zone
4	4	° Option 4 unacceptable from a transportation risk point of view ° Intersection/rail crossing separation is less than 180 m minimum requirement

- The selection of a preferred rail access and a preferred access road were interdependent for this site. In the selection of a preferred access road, it was desirable to minimize the number of level rail crossings. If Option 1 was selected as the preferred rail access, trucks leaving PI-1N from an access point south of Option 1 would have to traverse a level rail crossing. Option 1 was therefore eliminated as a rail access option. It was concluded, however, that Option 1 should be used as the access road exit point for intersite transfers between PI-1N and LF-4N.

- There are no occurrences of biological factors for any of the options. Option 4 was ranked lower than the other options based on an examination of the natural vegetation patterns.

- There are no potential impacts on residents associated with Options 1 and 2.

- There are no farm severances with Options 2 and 3 and no farm buildings in proximity to these routes. There are no surface water differences between Options 2 and 3.

- There are no offsetting advantages to Option 4. Option 4 has four residents within 170 m and seven residents within 250 m. There is one set of farm buildings within 250 m of Option 4. Option 4 involves two stream crossings.

- Option 2 is ranked higher than Option 3 from a transportation perspective. There is a higher cost associated with Option 3.

The overall ranking of rail access options and the rationale for the ranking is provided in Table 6.10.

Based on the above analysis, Options 1, 3 and 4 should be eliminated. Option 2 should be retained as the preferred rail access option to PI-1N.

TABLE 6.10

Overall Ranking of Rail Access Options

PI-1N

OPTION	RANKING	RATIONALE FOR RANKING
1	4	° Eliminated as a rail access option ° Used as an access road exit point for intersite transfers between PI-1N and LF-4N
2	1	° No social or land use impacts ° Highest ranked in terms of transportation safety and cost ° No farm severances, no farm buildings in close proximity ° No surface water features crossed
3	2	° Four residents within 170 m and 7 residents within 250 m ° No farm severances, no buildings in close proximity ° No surface water features crossed
4	3	° Four residents within 170 m and 7 residents within 250 m ° One set of farm buildings within 250 m ° Involves two surface water feature crossings

(c) LF-3C

Three rail access options were identified for LF-3C. These options are illustrated on Figure 6.4.

Option 2 is the preferred rail access for LF-3C. The main reasons for this conclusion include the following:

- The transportation consultant concluded that Option 3 was unacceptable from a transportation risk point of view. The intersection/rail crossing separation is less than the 180 m minimum required by the Ontario MTC for signing at-grade rail crossings on regional roadways.

- Options 1 and 2 are ranked equal from land use, socio-economic, transportation and engineering points of view. Option 1 bisects a small portion of SEU 18-10 (Southwestern Elcho Forest). Option 1 has a minor stream crossing and is therefore slightly less preferred than Option 2.

- Option 2 is preferred over Option 1 from an agricultural perspective. There are no farm parcels severed with Option 2 and no farm buildings in proximity of Option 2.

The overall ranking of rail access options and the rationale for the ranking is provided in Table 6.11.

Based on the above analysis, Options 1 and 3 should be eliminated. Option 2 should be retained as the preferred rail access to LF-3C.

(d) LF-9C

Five rail access options were identified for LF-9C. These options are illustrated on Figure 6.5.

TABLE 6.11

Overall Ranking of Rail Access Options

LF-3C

OPTION	RANKING	RATIONALE FOR RANKING
1	2	° No social or land use impacts ° Ranked same as Option 2 for transportation safety ° Passes through portion of SEU 18-10 (medium constraint) ° One stream crossed
2	1	° No social or land use impacts ° Ranked same as Option 1 for transportation safety ° No farm severances, no farm buildings in proximity of option ° No natural environment constraints ° No surface water constraints
3	3	° Unacceptable from a transportation risk point of view ° Intersection/rail crossing separation distance less than 180 m minimum requirement

Option 4 should be retained as the preferred rail access for LF-9C. The main reasons for this conclusion include the following:

- The transportation consultant concluded that Options 2 and 3 were unacceptable from a transportation risk point of view. Both options have an intersection/rail crossing separation less than the 180 m minimum required by the Ontario MTC for signing at-grade rail crossings on regional roadways.

- There are marginal differences between Options 1 and 4 from an engineering perspective. Option 4 is preferred to Option 1 based on land use, biological, social, surface water and agricultural considerations. Option 1 extends for about 5 km through an area of active farming. Option 1 involves a crossing of a portion of Sucker Creek containing pike spawning. It also bisects SEU 18-8 which is of greater significance than the portion of SEU 18-4 bisected by Option 4. Option 1 is the least preferred option from a surface water perspective. It involves four channel crossings and six wetland crossings.

  Option 4 is ranked lower than Option 1 from a transportation point of view because of a crossing of Provincial Highway 20. This crossing is partially mitigable with the application of rail crossing devices. Option 1 is preferred over both Options 4 and 5 from a transportation safety perspective.

- Option 4 is more desirable than Option 5 based on surface water and agricultural considerations. There is a significant difference between the options from an agricultural perspective. Option 5 would displace a farm building complex located adjacent to Highway 20. It also severs a farm parcel. There are no land severances with Option 4.

The overall ranking of rail access options and the rationale for the ranking is provided in Table 6.12.

Based on the above, Options 1, 2, 3 and 5 should be eliminated as rail access options. Option 4 should be the preferred rail access for LF-9C. The at-grade crossing of Highway 20 is expected to be mitigable through upgraded signal warnings. Option 4 is the preferred option assuming provision to address ways of mitigating the level rail crossing in Phase 4B.

(e) LF-1E

Four rail access options were identified for LF-1E. These options are illustrated on Figure 6.6. Options 1, 3 and 4 are on-site spur lines which connect to an existing ConRail line along the western site acquisition boundary. There are no off-site impacts associated with these options. The site selection team, therefore focused their analysis on Option 2.

Option 1 is the preferred rail access option to LF-1E. The main reasons for this conclusion include the following:

- Option 4 was excluded based on hydrogeologic constraints identified in a concurrent boundary refinement analysis. Rail access to the southern portion of the site would no longer be required since it was no longer feasible to locate a facility on this portion of the site.

- Option 3 no longer provided rail access to the physical/chemical treatment plant portion of the site.

- The transportation consultant concluded that Option 2 was unacceptable. Option 2 has an intersection/rail crossing separation less than the 180 m minimum required by the Ontario MTC for signing at-grade rail crossings on regional roadways.

- No off-site impacts were associated with Option 1.

TABLE 6.12

Overall Ranking of Rail Access Options

LF-9C

OPTION	RANKING	RATIONALE FOR RANKING
1	3	° 14 residents within 170 m and 18 residents within 250 m ° Favoured for transportation safety ° Extends through an actively farmed agricultural area ° 10 surface water features crossed
2	4	° Unacceptable from a transportation risk point of view ° Intersection/rail crossing separation less than 180 m minimum requirement
3	4	° Unacceptable from a transportation risk point of view ° Intersection/rail crossing separation distance less than 180 m minimum requirement
4	1	° 4 residents within 250 m ° No farm severances; one farm building in proximity ° One commercial facility (sausage retailing) within 250 m ° 6 surface water features crossed
5	2	° 11 residents within 250 m ° Involves displacement of one set of farm buildings, one severance ° 7 surface water features crossed

The overall ranking of rail access options and the rationale for the ranking is provided in Table 6.13.

Based upon the above analysis, Options 2, 3 and 4 should be eliminated. Option 1 should be retained as the preferred rail access option to LF-1E.

(f) PI-27E

Figure 6.7 indicates the one rail access option considered for PI-27E. As noted in the constraint mapping discussion, the option consists of an existing ConRail line running diagonally through the site. No on-site impacts, with the exception of cost, were associated with this option.

Option 1 should be retained as the preferred rail access to PI-27E.

6.3.5 CONCLUSIONS

Preferred rail access options were identified for six of the candidate sites - LF-4N, PI-1N, LF-3C, LF-9C, LF-1E and PI-27E. Rail service is considered an opportunity. As a result it is not included in the detailed comparative evaluation of siting options. The effect of the provision of rail service on the ranking of siting options is, however, examined in a sensitivity analysis documented in Chapter 8 (Volume 2).

TABLE 6.13

Overall Ranking of Rail Access Options

LF-1E

OPTION	RANKING	RATIONALE FOR RANKING
1	1	° No off-site impacts
2	2	° Unacceptable from a transportation risk point of view ° Intersection/rail crossing separation less than 180 m minimum requirement
3	2	° Does not provide rail access to physical/chemical treatment plant portion of site
4	2	° Does not provide rail access to physical/chemical treatment plant portion of site

7.0 LOCATION OF THE PHYSICAL/CHEMICAL TREATMENT PLANT FOR PARTIALLY INTEGRATED SITING OPTIONS

7.1 INTRODUCTION

7.1.1 PURPOSE

Among the siting options, there are three types of facility configurations. A fully integrated facility option involves a landfill, a physical/chemical treatment plant and an incinerator, all located on one site. A partially integrated facility option has two sites. It involves the choice of locating the physical/chemical treatment plant with the landfill site (Case 3)* or with the incinerator site (Case 2)*. This step determines the preferred location for the physical/chemical treatment plant with the landfill or with the incinerator.

7.1.2 ORGANIZATION

The process used to determine the location for the physical/chemical treatment plant is introduced first in this chapter, followed by a description of the methodology employed to identify, rank and aggregate (or combine) the factors. Application of the factors is presented in two steps. First, the issues and tradeoffs associated with the alternative location for the treatment plant are presented. The issues and tradeoffs, together with two cross-checking procedures, are then employed to rank the options. Conclusions regarding each step and final conclusions are documented for each siting option.

7.2 APPROACH

7.2.1 COMPARISON CONSIDERATIONS

Several considerations were important in determining the location of the physical/chemical treatment plant. In terms of the transportation requirements, there are important differences between a Case 2 and a Case 3 site operation. In a Case 2 operation (separate landfill), all wastes and process additives and reagents would be transported to the PI site. Only transfer movements would occur between the PI and LF sites. In a Case 3 operation (separate incinerator), a portion of the wastes and additives and reagents would be carried to the PI site (for incineration), and a portion would be carried to the LF site (physical/chemical treatment). However, there would be a substantial decrease in the number of transfer movements between the sites. Some wastes could be deposited directly into the landfill following treatment at the physical/chemical treatment plant. Figure 7.1 illustrates the movements to and between the two components of partially integrated siting options.

The noise levels on and off-site associated with each pairing of facilities was also a consideration. The compatibility of the physical/chemical treatment plant with surrounding land uses, potential risk as a result of fugitive emissions* from the physical/chemical treatment plant[1] and the greater potential displacement of natural features on the site where the physical/chemical treatment plant is located were also important considerations in the evaluation process.

7.2.2 PROCESS

The process for choosing the best site for the location of the physical/chemical treatment plant took place in six steps:

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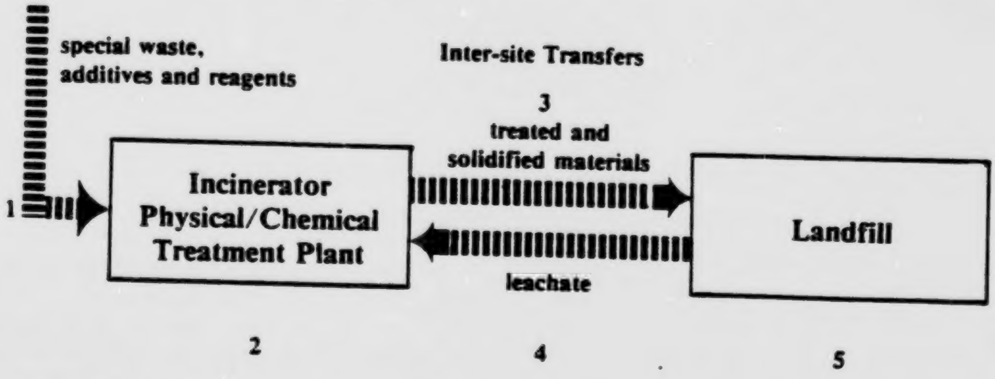
[1] Fugitive emissions are emissions from sources other than the incinerator stack (e.g. dust along roadways, emissions released when barrels opened).

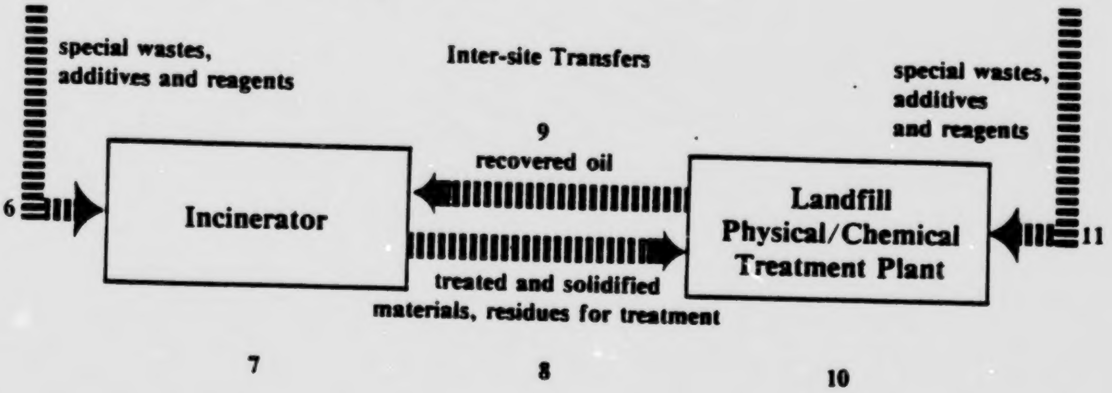
FIGURE 7.1

SCHEMATIC OF PARTIALLY INTEGRATED SITING OPTIONS

OPTION 1: The physical/chemical treatment plant with the incinerator and the landfill facility on a separate site.


special waste,
additives and reagents
Inter-site Transfers
3
treated and
solidified materials
1
Incinerator
Physical/Chemical
Treatment Plant
Landfill
leachate
2
4
5

OPTION 2: The physical/chemical treatment plant with the landfill facility and the incinerator on a separate site.


special wastes,
additives and reagents
Inter-site Transfers
special wastes,
additives
and reagents
9
recovered oil
6
Incinerator
Landfill
Physical/Chemical
Treatment Plant
11
treated and solidified
materials, residues for treatment
7
8
10

LEGEND

1 = access route for transporting - special waste, additives and reagents to the physical/chemical treatment plant
2 = site of the incinerator and the physical/chemical treatment plant
3 = inter-site transfer route for the treated and solidified materials from the incinerator and physical/chemical treatment plant to the landfill facility
4 = inter-site transfer of leachates from the landfill to the incinerator and physical/chemical treatment plant
5 = site of the landfill facility
6 = access route for transporting special wastes and additives and reagents to the incinerator
7 = incinerator site
8 = inter-site transfer route for transporting treated and solidified materials and residues for treatment from the incinerator to the landfill facility and physical/chemical treatment plant
9 = transfer route for transporting recovered oil from the physical/chemical treatment plant to the incinerator
10 = site of the physical/chemical treatment plant and the landfill facility
11 = access route for transporting special waste, additives and reagents to the physical/chemical treatment plant.

1) Identification of factors and indicators;

2) Screening of factors and indicators;

3) Ranking of factors and indicators;

4) Preliminary aggregation of factors and indicators;

5) Identification of issues and tradeoffs by risk and study area groupings;

6) Cross-check of results by factor and factor grouping, including a quantitative comparison.

Figure 7.2 illustrates the process applied.

Several consultants provided input to the transportation component of this analysis. Consequently, the data inputs were provided by individual consultants and aggregated in a series of composite indices by the transportation consultant - M.M. Dillon Ltd. Overall coordination was provided by the site selection consultant (also M.M. Dillon Ltd.).

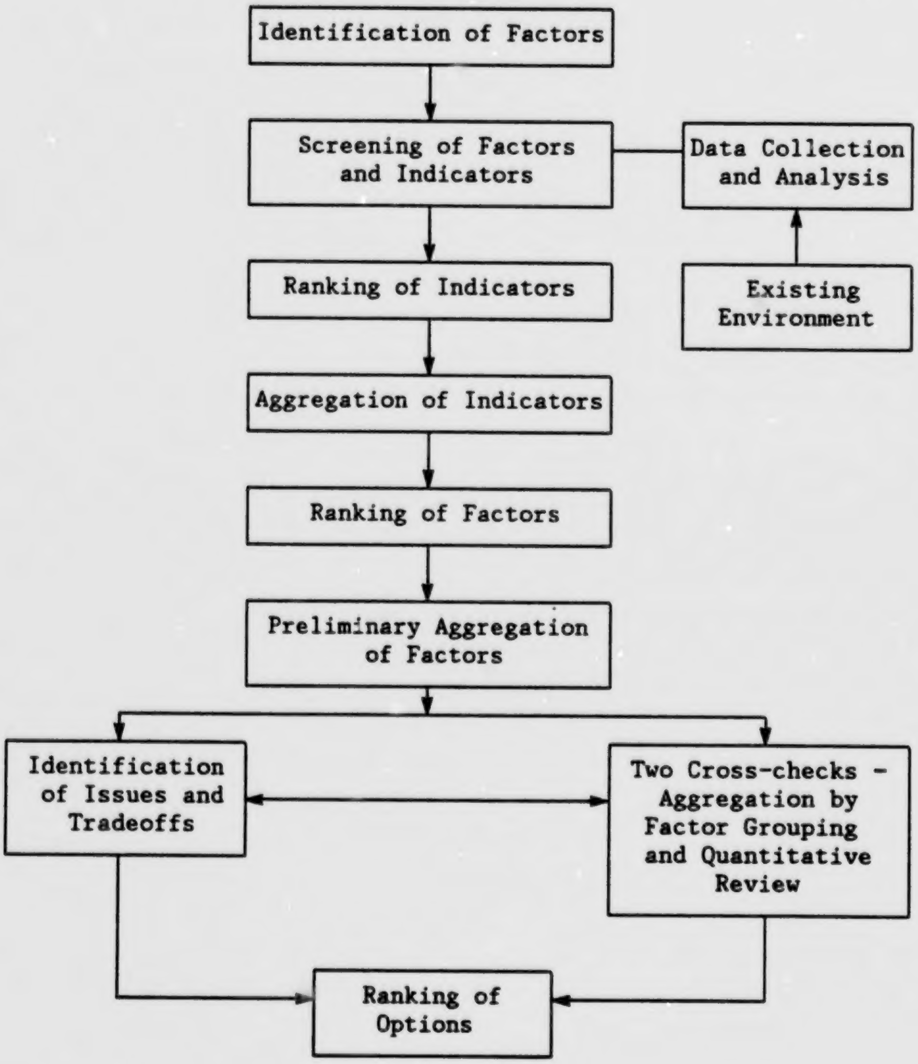
7.2.3 SCOPE AND LEVEL OF DETAIL

The following site selection consultants provided input to the decisions regarding the location of the physical/chemical treatment plant:

Firm	Input Provided
M.M. Dillon	- Transportation risk
ORF	- Air quality risks and impacts
Environ	- Input regarding risk factor rankings and study areas
GLAL	- Surface water transportation risks (applied by M.M. Dillon)

FIGURE 7.2

PROCESS USED IN SELECTION OF THE PREFERRED LOCATION FOR THE PHYSICAL/CHEMICAL TREATMENT PLANT


Identification of Factors
Screening of Factors and Indicators
Data Collection and Analysis
Ranking of Indicators
Existing Environment
Aggregation of Indicators
Ranking of Factors
Preliminary Aggregation of Factors
Identification of Issues and Tradeoffs
Two Cross-checks - Aggregation by Factor Grouping and Quantitative Review
Ranking of Options

Firm	Input Provided
GLAL	- Hydrogeology
IER	- Social impacts analysis and inputs to transportation risk analysis
LKA	- Land use
Ecologistics Ltd., Deloitte, Haskins and Sells	- Agricultural resources
GLAL	- Biological resources
Monenco	- Landfill life and cost inputs

The scope and level of detail applied for this step was not as comprehensive and as refined as that applied in the comparison of siting options. It was, however, appropriate based upon the limited differences in the size of the facility, the level of impacts and risks associated with the facility, the small geographic area affected and the fact that in each case only two options were compared based on a small number of differences. In each case it was therefore possible to focus on major differences in potential risks, impacts and costs, recognizing factor ranking differences.

Both present and potential future impacts and risks were included in the analysis where possible.

7.2.4 DATA COLLECTION AND ANALYSIS

Data were provided by the consultants listed in Section 7.2.3 in the form of information by factor and aggregated by discipline. In all cases, previously obtained data were used. It was, however, necessary to compile and interpret that data to reflect the major potential risks, impacts and costs associated with the placement of the physical/chemical treatment plant.

Exceptions to this were GLAL-Biology, Environ Corp. and M.M. Dillon Ltd. GLAL-Biology undertook a qualitative review of the options under consideration. They provided general conclusions regarding a preference for Case 2. · Environ Corp. assisted in the definition of study areas, the hazards evaluation and in the ranking of risk factors. As previously mentioned, the aggregation of transportation inputs was undertaken jointly by M.M. Dillon-Transportation and by other site selection consultants.

The data collection and analysis process included:

- field investigations in the site, site vicinity and access roads study areas, e.g. number and characteristics of residents, land use characteristics, noise, agricultural and biological investigations;
- reviews of secondary source data, e.g. census, municipal data and transportation spills and accident data;
- engineering design and cost studies.

The data collected were analyzed and synthesized in a variety of ways, including:

- the use of models, e.g. transportation and air dispersion;
- the calculation of risk and impact indices, e.g. transportation, agriculture, air quality;
- the preparation of individual and composite maps, e.g. noise and social impacts.

7.2.5 STUDY AREAS

Five study areas were used in the choice of location for the physical/chemical treatment plant:

Factor Grouping	Study Area
Transportation Risk	° The local and regional access routes were considered. For analysis of risk of spills for receptors (e.g. residents, community and recreation features) 150 m and 150-500 m zones from the centre line of roadways were applied. The risk zones were identified by the risk consultant - Environ Corp.[1]
Air Quality Risks and Impacts	° An area extending 5 km out from the centre of sites was applied. The air dispersion zone was identified by the air quality consultant - The Ontario Research Foundation.
Social, land use, agricultural and biological impacts	
- site	° The refined acquisition boundaries were applied.
- site vicinity	° Within the site vicinity (approximately 2 km from centre of sites) noise impact zones and a 1,000 m study area for land use were applied. These addressed the major direct off-site impacts.
- access roads	° Areas adjacent to local and regional access routes and within 800 m were applied. This addressed the major direct access road impacts.

7.2.6 FACILITIES CHARACTERISTICS ASSUMPTIONS

The facility characteristics assumptions applied by the site selection consultants are listed in Table 7.1 together with a rationale for their use.

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[1] The rationale for the 150 m. and 500 m. bands is provided in Appendix E.

Table 7.1

FACILITIES CHARACTERISTICS ASSUMPTIONS

Assumption		Role in Analysis
1. Size of Operations Area		
° Incinerator alone	° 10.7 ha	° The size of the operations area influences the potential displacement of on-site features
° Incinerator and physical/chemical treatment plant	° 17.7 ha	
2. Facility Operation		
° The physical/chemical treatment plant and incinerator will operate three shifts a day; the landfill will operate one shift unless it is on a site with a physical/chemical treatment plant in which case it will operate three shifts a day		° The operations characteristics of the facility influence potential impacts such as noise, access and nuisance effects
° The landfill and physical/chemical treatment plant will operate 5 days a week; the incinerator will operate 7 days a week		
° Truck movements to a facility will occur during daytime hours on a 5-day schedule, Monday through Friday		
3. Transportation		
° All waste will be transported by road		° The characteristics of the transportation system influences the nature and magnitude of potential impacts and risks
° All shipments of bulk reagents and/or additives will arrive by road		

OPTIONS UNDER CONSIDERATION

The specific siting options involved in this comparison were[1]:

A. PI-27E/LF-1E

1. The incinerator and physical/chemical treatment plant at PI-27E and a landfill at LF-1E; or
2. The incinerator at PI-27E and the landfill and physical/chemical treatment plant at LF-1E.

B. PI-13N/LF-4N

1. The incinerator and physical/chemical treatment plant at P1-13N and the landfill at LF-4N; or
2. The incinerator at PI-13N and the physical/chemical treatment plant and landfill at LF-4N.

C. PI-1N/LF-4N

1. The incinerator and physical/chemical treatment plant at PI-1N and the landfill at LF-4N; or
2. The incinerator at PI-1N and the landfill and physical/chemical treatment plant at LF-4N.

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[1] Siting options that included site LF-2N were dropped from further consideration by OWMC in May, 1985. Therefore, they do not appear in this analysis. The rationale for the dropping of LF-2N is summarized in (M.M. Dillon Ltd., 1985a).

7.3 EXISTING ENVIRONMENT

The existing environment for the siting options is limited to the site, the site vicinity and the access roads to and between the sites. An overview of the site and site vicinity environments is provided in Chapter 3 (Volume II). An overview of the access road environments is provided in Chapter 6 (Volume I).

7.4 IDENTIFICATION AND SCREENING OF FACTORS AND INDICATORS

7.4.1 IDENTIFICATION OF FACTORS

The initial list of factors and indicators is presented in Tables 7.2 to 7.3. The rationale for the selection of these factors is presented in Table F.1 in Appendix F.

7.4.2 SCREENING OF FACTORS AND INDICATORS

The process used to select and screen indicators and factors, prior to input to the site selection team, is documented in the consultants' individual reports. Two factors and one indicator were screened from the analysis after the inputs were supplied to the site selection team. The hydrogeology, existing land use, number of industrial/commercial facilities and land use transportation impact index factors/indicators were not used in the analysis for the following reasons.

TABLE 7.2

RISK FACTORS IDENTIFIED FOR USE IN SELECTION OF THE PHYSICAL/CHEMICAL PLANT LOCATION

Factor Grouping	Factor	Indicator
A. RISK		
Transportation	° Transportation Risk due to Spills: Risk to human and environmental receptors along local and regional access roads due to the hazard based spill index for the transport of special wastes, additives and reagents, and inter-site transfers	° Road user risk index associated with hazard based spills index ° Population risk index associated with hazard based spill index ° Sensitive community and recreational features risk index associated with the hazard based spill index ° Surface water risk index associated with the hazard based spill index
	° Transportation Risk due to Accident Involvement: Risk to road users on local and regional access roads due to the involvement in accidents by trucks carrying special wastes, additives and reagents, and inter-site transfers	° Road user risk index associated with OWMC generated trucks involved in accidents
Hydrogeology	° Capability to provide natural containment	° None identified
Air Quality	° Risks from Direct Inhalation of Emissions - Chronic	° Relative population exposure - fugitive emissions ° Relative future population exposure - fugitive emissions
	° Risks from Direct Inhalation of Emissions - Acute	° Topographic features on or around site

TABLE 7.2

RISK FACTORS IDENTIFIED FOR USE IN SELECTION OF THE PHYSICAL/CHEMICAL PLANT LOCATION

Factor Grouping	Factor	Indicator
A. RISK Air Quality (Continued)		° Relative population exposure - upset emissions from low elevation sources ° Relative future population exposure - upset emissions from low elevation sources ° Distribution of community facilities
	° Risks from Ingestion of Cistern and Pond Water	° Relative exposure from cistern and pond water - fugitive emissions
	° Risks from Consumption of Crops and Livestock	° Relative sensitive crop exposures - fugitive emissions ° Relative sensitive livestock exposures - fugitive emissions ° Relative future sensitive crop exposures - fugitive emissions ° Relative future sensitive livestock exposures - fugitive emissions

TABLE 7.3

IMPACT FACTORS IDENTIFIED FOR USE IN SELECTION OF THE PHYSICAL/CHEMICAL PLANT LOCATION

Study Area	Factor Grouping	Factor	Indicator
B. IMPACT			
Site	Land Use	° Proposed and planned land use	° Land use designations
	Natural Environment	° Displacement of natural features	° None identified
Site Vicinity	Residents	° Disruption of day-to-day activities and/or use and enjoyment of properties	° Number of residents within 50 dBA and 55 dBA noise impact zones
	Land Use	° Existing land use	° Number of residences ° Number of industrial/commercial facilities
		° Planned and proposed land use	° Land use designations
	Agricultural Resources	° Disruption of existing farm operations	° Number of farms with headquarters in the vicinity
		° Agricultural community impacts	° Percent of land in non-farm uses ° Percent of farmland that is owned ° percent of farmland in parcels > 12.6 ha
	Air Quality	° Restraints to Dispersion	° Local modifications to dispersion climatology
		° Existing and Anticipated Air Quality	° Existing air quality ° Existing short term air quality

TABLE 7.3

IMPACT FACTORS IDENTIFIED FOR USE IN SELECTION OF THE PHYSICAL/CHEMICAL PLANT LOCATION

Study Area	Factor Grouping	Factor	Indicator
B. IMPACT			
Site Vicinity (Continued)			° Estimated effect on air quality - fugitive emissions
Access Roads	Residents	° Disruption of day-to-day activities and/or use and enjoyment of properties	° Number of residents within 55 dBA noise impact zone ° Impact index (adjacent to access routes) ° Impact index (access routes 800 m study area)
	Community and Recreation Features	° Disruption of operations of community and recreation features	° Impact index (adjacent to access routes) ° Impact index (access routes 800 m study area)
	Land Use	° Transportation impact index	° Number of residences, commercial facilities and AADT[1]
	Agricultural Resources	° Disruption of existing farm operations	° Number of farms with headquarters ° Agricultural vehicle impact index
	Natural Environment	° Disruption of fish communities	

[1] Average Annual Daily Traffic (AADT)

TABLE 7.3

ENGINEERING COST FACTORS IDENTIFIED FOR USE IN SELECTION OF THE PHYSICAL/CHEMICAL PLANT LOCATION

Factor Grouping	Factor	Indicator
C. ENGINEERING COST		
Cost	° Capital cost	° Total estimated cost
	° Operating cost	° 10-year operating cost
Engineering Flexibility	° Site size	° Landfill life

A comparative analysis of the options for locating the physical/ chemical treatment plant would require a thorough understanding of introducing additional potential contaminants to the hydrogeologic setting. The location of the physical/chemical treatment plant, at either the landfill or the incineration plant site, would potentially add to the contaminant loadings and increase the potential risk already anticipated for those sites. It is, however, not possible to establish whether the combined potential risks would be greater if the treatment plant were located at either the landfill or with the incinerator. This is because the composition, toxicity and quantities of contaminants potentially released from the facilities cannot be fully anticipated (GLAL, 1985b). Thus, it was not possible to compare the sites based on the factor "capability to provide natural containment". If the sites were hydrogeologically unacceptable for the landfill and incinerator components, then they would also be unacceptable for the physical/chemical treatment plant. Therefore, the factor was screened from the analysis.

Portions of two land use factors were also screened from the analysis. For both site vicinity and access roads, impacts of the placement of the treatment plant on businesses are expected to be minor and could be positive. Consequently, these indicators did not warrant inclusion in the analysis. Impacts on residences along access routes, as part of the land use transportation impact index, measured disruption to residents' use of their homes. This indicator was screened from the analysis because it duplicated the inputs provided by the "disruption of day-to-day activities and/or use and enjoyment of properties" factor. These land use factors/indicators, screened from the analysis, were important in the development of an overall perspective by the land use consultant.

7.5 RANKING AND AGGREGATION OF INDICATORS AND FACTORS

7.5.1 RANKING OF INDICATORS

The procedures used to rank and aggregate indicators are documented in the site selection consultants' individual reports, with the exception of transportation. In the case of transportation risks, inputs were provided by the social, surface water and risk consultants to M.M. Dillon-Transportation. Rankings for the indicators were developed by these consultants with coordination by M.M. Dillon-Site Selection.

Table F.2, in Appendix F, provides the ranking levels applied to the transportation risk indicators and the rationale for the rankings. The rankings are based on the severity and frequency of the risk, and the potential for mitigation. M.M. Dillon-Transportation applied these levels as weights to reflect the relative importance of the factors in the quantitative analysis of transportation risks.

7.5.2 AGGREGATION OF INDICATORS

The procedures used to aggregate indicators are documented in the site selection consultants' individual reports, with the exception of transportation. Transportation inputs were in the form of both traffic data and information on receptors along roadways (e.g. residents, surface water, road users). Transportation indices were developed to combine subindicator information on potential spill frequencies, the relative hazard of the commodity carried, the number and type of receptors and the receptor distance from the roadway. The indices were used as indicators of potential risk from spills along access routes.

The risk receptor data, supplied by the site selection consultants, were submitted as follows:

- Population data (supplied by Institute of Environmental Research):

  Receptor data for each road section = (population within 150 m of roadway x 10) + (population located 150 to 500 m from roadway);

- Sensitive community and recreation features data[1] (supplied by Institute of Environmental Research):

  Receptor data for each road section = (features within 150 m from roadway x 10) + (features located 150 to 500 m from roadway);

- Possibility of spill entering surface water pathway data (supplied by Gartner Lee Associates):

  Receptor data for each road section = length of road section where spilt material may enter a stream — total length of road section.

Population and community and recreation features data within 150 m of the roadway were weighted ten times higher than within 150-500 m of the roadway. This ranking was based on an analysis of potential risks associated with a spill using conservative assumptions regarding the severity of the spill conditions. The analysis indicated that risks to receptors are considerably greater for locations close to the spill event (Environ Corp., 1985).

The calculation used to develop spills index indicators was as follows:

Spills Index = Sum for all road sections: (Receptor data for each road section x Annual No. of spills on each road section x Hazard Index).

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[1] This indicator was screened from the analysis by M.M. Dillon - Transportation because no features were found.

The hazard index refers to weights applied to the commodities transported by OWMC-generated vehicles. The index used is as follows:

Hazard Index =	Special wastes	10
	Additives and reagents	1
	Transfer materials	1

An analysis of the potential risks associated with spills from these commodities indicated a considerably greater potential impact on human health associated with special wastes than additives and reagents or transfer materials (Environ Corp.).

The transportation indices were aggregated into factor values by M.M. Dillon based on the indicator weights identified (see M.M. Dillon, 1985, Volume II, Chapter 7).

7.5.3 RANKING OF FACTORS

With the exception of GLAL-Biology, all of the site selection consultants ranked the factors associated with their discipline in order of importance. In some cases, numerical values or weights were associated with the ranking levels. These values assisted in determining the magnitude of differences in the importance of factors within one discipline. Tables F.3 and F.4 in Appendix F lists the consultants rankings and rationale for rankings.

The site selection consultants provided their rankings and a rationale for their ranking. A composite ranking was developed by Dillon Site Selection using a three-level system. Tables 7.4 and 7.5 list the factor rankings and the rationales for the risk and impact factor rankings, respectively. The criteria used in ranking risk factors were frequency/duration of risk, severity and mitigation potential. For impact factors the criteria were severity and frequency of impact, mitigation

TABLE 7.4

RANKING OF RISK FACTORS USED IN CHOICE OF LOCATION OF THE PHYSICAL/CHEMICAL TREATMENT PLANT

Factor Grouping	Factor	Rank[1]	Rationale
A. RISK			
Transportation	° Transportation Risk due to Spills: Risk to human and environmental receptors along local and regional access roads due to the hazard based spill index for the transport of special wastes, additives and reagents, and inter-site transfers	3	° Frequency of potentially severe event is low ° Margin of safety is less than one (measurable health effects) for some waste streams, for person at location 20 m from spill ° Severity of effects dependent on nature and type of spill and proximity and sensitivity of individuals involved ° Mitigation cannot be assumed but possible through fast response and clean-up ° Local and regional access road risks are perceived by public as major concern
	° Transportation Risk due to Accident Involvement: Risk to road users on local and regional access roads due to the involvement in accidents by trucks carrying special wastes, additives and reagents, and inter-site transfers	3	° Potentially severe effects ° Frequency of potentially severe effects is low ° Mitigation cannot be assumed

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[1] 3 is greatest importance and 1 is least importance

TABLE 7.4

RANKING OF RISK FACTORS USED IN CHOICE OF LOCATION OF THE PHYSICAL/CHEMICAL TREATMENT PLANT

Factor Grouping	Factor	Rank	Rationale
A. RISK			
Transportation (Continued)			° Local and regional access road risks are perceived by public as major concern
Air Quality	° Risks from Direct Inhalation of Emissions - Chronic	1	° Relatively small routine or chronic emissions from the physical/chemical treatment plant ° Relatively low concern with regard to risk to human health (Environ, 1985) ° Mitigation potential exists
	° Risks from Direct Inhalation of Emissions Acute	2	° Mixing of incompatible wastes could result in release of significant quantity of toxic vapours (Environ, 1985) ° No adverse health effects predicted (Environ, 1985) ° Mitigation potential limited
	° Risks from Ingestion of Cistern and Pond Water	1	° No adverse health effects predicted (Environ, 1985) ° Indirect pathway

TABLE 7.4

RANKING OF RISK FACTORS USED IN CHOICE OF LOCATION OF THE PHYSICAL/CHEMICAL TREATMENT PLANT

Factor Grouping	Factor	Rank	Rationale
A. RISK Air Quality (Continued)			° Potential for mitigation
	° Risks from Consumption of Crops and Livestock	1	° No adverse health effects predicted (Environ, 1985) ° Indirect pathway ° Potential for mitigation

TABLE 7.5

RANKING OF IMPACT FACTORS USED IN CHOICE OF LOCATION OF THE PHYSICAL/CHEMICAL TREATMENT PLANT

Study Area	Factor Grouping	Factor	Rank	Rationale
B. IMPACT				
Site	Land Use	° Proposed and planned land use	1	° Little difference occurs between Case 2 and Case 3 with respect to displacement on-site
	Natural Environment	° Displacement of natural features	1	° Little difference occurs between Case 2 and Case 3 with respect to displacement on-site
Site Vicinity	Residents	° Disruption of day-to-day activities and/or use and enjoyment of properties	3	° Differences in noise are expected to occur between Case 2 and Case 3 ° Direct and long-term impacts ° Impacts may not be fully mitigable
	Land Use	° Existing land use	3	° Range of impacts other than noise possible (e.g. visual) ° Direct and long-term impacts ° Impacts may not be fully mitigable
		° Planned and proposed land use	3	° Planned land use basis for making public and private decisions ° Planned and proposed land uses a direct reflection of community expectations for area

TABLE 7.5

RANKING OF IMPACT FACTORS USED IN CHOICE OF LOCATION OF THE PHYSICAL/CHEMICAL TREATMENT PLANT

Study Area	Factor Grouping	Factor	Rank	Rationale
B. IMPACT Site Vicinity (Continued)				° Potential for mitigation
	Agricultural Resources	° Disruption of existing farm operations	3	° Both direct and indirect impacts are possible ° Impacts may be of long duration ° Impacts may not be fully mitigable
		° Agricultural community impacts	3	° Potential for impact is less where non-agricultural developments have already intruded into agricultural areas ° Although impacts expected to be minor to moderate, potential for more serious impacts than anticipated because of role of perception and dependent on voluntary decisions of individuals ° Little opportunity for mitigation
	Air Quality	° Restraints to dispersion	1	° Sites with significant restraints to dispersion were excluded in previous site selection stages ° Any restraints on emissions from the treatment plant due to other sources of

TABLE 7.5

RANKING OF IMPACT FACTORS USED IN CHOICE OF LOCATION OF THE PHYSICAL/CHEMICAL TREATMENT PLANT

Study Area	Factor Grouping	Factor	Rank	Rationale
B. IMPACT				
Site Vicinity (Continued)				emissions in the vicinity are unlikely, but could be easily accommodated due to the very small emission quantities and the flexibility afforded by the batch operations employed
		° Existing and anticipated air quality	1	° Incremental effects due to emissions from the treatment plant are very small
Access Roads	Residents	° Disruption of day-to-day activities and/or use and enjoyment of properties	3	° Potential for a variety of impacts (e.g. noise, accessibility, vibration dust and nuisance) ° Effects are long-term and direct ° Impacts may not be fully mitigable
	Community and Recreation Features	° Disruption of operations of community and recreation features	1	° Disruption of community and recreation features indirect and expected to be low ° Impacts may be mitigable
	Agricultural Resources	° Disruption of existing farm operations	3	° Potential for direct impacts ° Impacts may be long-term

TABLE 7.5

RANKING OF IMPACT FACTORS USED IN CHOICE OF LOCATION OF THE PHYSICAL/CHEMICAL TREATMENT PLANT

Study Area	Factor Grouping	Factor	Rank	Rationale
B. IMPACT Access Roads (Continued)				° Impacts may not be fully mitigable
	Natural Environment	° Disruption of fish communities	2	° Likelihood of spill into watercourse such that fish mortality occurs is extremely remote ° Zone of impact may be local ° Potential for remedial action

potential and significance of impact. A more detailed description of these criteria is provided in Chapter 5 in Volume 2.

In the final comparison of siting options, a ten-level ranking scheme was used. The same level of detail as the detailed comparative evaluation was not required for the following reasons:

- The range of facility changes being compared was limited;

- There were significant differences between Cases 2 and 3. As a result, only a limited range of factors and rankings was required to make decisions;

- The information on risk factor ranking, supplied by the generic risk analysis, was based on the full facilities. It was, therefore, not appropriate for consideration of the physical/chemical treatment plant alone.

No ranking was applied to the engineering cost and flexibility factors. Rather, these factors were applied after major differences in risks and impacts had been established. They were used where only minor or subtle differences in risks and impacts were identified.

7.5.4 PRELIMINARY AGGREGATION OF FACTORS

In order to facilitate the comparison of the Case 2 and Case 3 options, it was first necessary to group similar or associated factors (see Table 7.6). These groupings were applied in the application of the factors for determining the location for the physical/chemical treatment plant.

Table 7.6

AGGREGATION OF FACTORS USED IN CHOICE OF LOCATION FOR THE PHYSICAL/CHEMICAL TREATMENT PLANT

FACTOR	AGGREGATED FACTOR GROUPINGS
A. RISK	
Transportation risk due to spills	Transportation risk due to spills
Transportation risk due to accident involvement	Transportation risk due to accident involvement
Risks from direct inhalation of emissions - chronic	Risks from direct inhalation
Risks from direct inhalation of emissions - acute	
Risks from ingestion of cistern and pond water	Risks from indirect air quality pathways
Risks from consumption of crops and livestock	
B. SITE	
Proposed and planned land use	On-site impacts
Displacement of natural features	
Hydrogeology	Screened
C. SITE VICINITY	
Disruption of day-to-day activities and/or use and enjoyment of properties	Impacts on residents
Existing land use (residences) (commercial/industrial)	

Table 7.6

AGGREGATION OF FACTORS USED IN CHOICE OF LOCATION FOR THE PHYSICAL/CHEMICAL TREATMENT PLANT

FACTOR	AGGREGATED FACTOR GROUPINGS
C. SITE VICINITY	(cont'd)
Disruption of existing farm operations	Impacts on agricultural resources
Agricultural community impacts	
Restraints to dispersion	Impacts on air quality
Existing and anticipated air quality	
Planned and proposed land use	Future land use impacts
D. ACCESS ROADS	
Disruption of day-to-day activities and/or use and enjoyment of properties	Impacts on residents
Disruption of operations of community and recreation features	Impacts on community and recreation features
Disruption of farm operations	Impacts on agricultural resources
Disruption of fish communities	Impacts on natural environment
Land use transportation impact index	Screened

7.6 APPLICATION OF FACTORS

7.6.1 INTRODUCTION

The application of factors took place in two steps. In step one, issues and tradeoffs associated with the alternative treatment plant locations were identified by risk and study area factor groupings. A qualitative review of the differences between the Case 2 and Case 3 situation was undertaken based on the factor rankings. Conclusions were then reached regarding the preferred location for the plant.

In step two, two cross-checks of the qualitative analysis were undertaken. The alternative locations were compared by factor and factor grouping, applying the factor rankings. A quantitative aggregation procedure was also employed. Conclusions were again reached and checked against those reached in step one.

7.6.2 LF-1E/PI-27E

Site PI-27E is the preferred location for the physical/chemical treatment plant. Table 7.7, outlines the detailed issues and tradeoffs identified in step one with regard to risks, impacts and engineering concerns. Table F.5 documents the step two cross-check aggregation of factors by factor grouping and the quantitative aggregation.

In summary, the review of issues and tradeoffs determined that Case 2 is preferred over Case 3 for transportation risk. No preference was identified for air quality risk factors.

Case 2 is preferred for all on-site and access road impact factors except for impacts on vicinity residents.

Table 7.7

ISSUES AND TRADEOFFS
LOCATION OF THE PHYSICAL/CHEMICAL TREATMENT PLANT
LF-1E/PI-27E

FACTOR GROUPING/ STUDY AREA	MAJOR ISSUES CASE 2 (PI-27E LOCATION)	MAJOR ISSUES CASE 3 (LF-1E LOCATION)	DIFFERENCES BETWEEN CASES 2 AND 3
A. RISK			
Transportation	° Case 2 has lower risks to all receptors due to potential spills and accidents because there are 30% fewer trucks travelling the 2.7 km between the 2 sites	° slightly higher risk to all receptors due to potential spills and accidents	° Case 2 is preferred over Case 3 for transportation risk
Air Quality	° two of four risk indicators for acute emissions favour location of the treatment plant at PI-27E ° exposure index for cisterns and ponds clearly favours Case 2 ° all indicators for risks from consumption of livestock marginally favour PI-27E	° one of four risk indicators for acute emissions favour Case 3 ° chronic emissions indicators clearly favour Case 3	° no clear preference is apparent for air quality risk

Table 7.7

ISSUES AND TRADEOFFS
LOCATION OF THE PHYSICAL/CHEMICAL TREATMENT PLANT
LF-1E/PI-27E

FACTOR GROUPING/ STUDY AREA	MAJOR ISSUES CASE 2 (PI-27E LOCATION)	MAJOR ISSUES CASE 3 (LF-1E LOCATION)	DIFFERENCES BETWEEN CASES 2 AND 3
A. IMPACTS			
Site	° PI-27E is designated industrial and is compatible for the location of the physical/chemical treatment plant	° LF-1E is 100% agriculturally designated and would not be as compatible with the physical/chemical treatment plant	° Case 2 is preferred because land uses are more compatible
	° location of the physical/chemical treatment plant with the incinerator result in greater displacement of natural features for PI-27E; small difference	° location of the physical/chemical treatment plant with the landfill may result in greater displacement of natural features for LF-1E; small difference	° disturbances to natural features expected to be less for Case 2 ° no stream crossings for LF-1E or PI-27E
Site Vicinity	° more residents in the noise impact zone than Case 3 but fewer residences within 1000 m	° fewer residents in noise impact zone than Case 2 but more residences within 1000 m	° no clear preference with regard to site vicinity impacts on residents
	° agriculture less viable for Case 2 (less farm headquarters (9), less owned land, smaller farm parcels and more non-farm land for PI-27E)	° agriculture more viable for Case 3 (more farm headquarters (27), owned land, less non-farm land and larger parcels for LF-1E)	° agriculture more viable for LF-1E; Case 2 preferred for agricultural resources

Table 7.7

ISSUES AND TRADEOFFS
LOCATION OF THE PHYSICAL/CHEMICAL TREATMENT PLANT
LF-1E/PI-27E

FACTOR GROUPING/ STUDY AREA	MAJOR ISSUES CASE 2 (PI-27E LOCATION)	MAJOR ISSUES CASE 3 (LF-1E LOCATION)	DIFFERENCES BETWEEN CASES 2 AND 3
B. IMPACTS			
	° existing and anticipated air quality is relatively low for PI-27E	° existing and anticipated air quality is less of a constraint for LF-1E	° preference for location of treatment plant at LF-1E (Case 3) based on air quality impacts
	° more compatible industrial lands near PI-27E (44% industrial)	° physical/chemical treatment plant would be located in agricultural area (2% industrial)	° clear preference for Case 2 based on future land use
Access Roads	° impact indices for adjacent residents are lower for Case 2 but higher for vicinity residents (14.1 adjacent and 88.9 for 800 m study area)	° greater impact indices for adjacent and lower for vicinity residents (16.1 for adjacent and 100.1 for 800 m study area)	° no difference for noise impacts on residents ° greater impact indices (vibration, access, nuisance) for Case 3 than Case 2 ° impact indices for community and recreation features are equal for Case 2 and Case 3
	° fewer farms and farm vehicle impacts because transport from 400 series highways to PI-27E only	° greater impact on farms and farm vehicles because transport from the 400 series highway to both the PI and landfill occurs	° preference for Case 2 for agriculture along access routes
	° no stream crossings	° no stream crossings	° no impacts on fisheries

Table 7.7

ISSUES AND TRADEOFFS
LOCATION OF THE PHYSICAL/CHEMICAL TREATMENT PLANT
LF-1E/PI-27E

FACTOR GROUPING/ STUDY AREA	MAJOR ISSUES CASE 2 (PI-27E LOCATION)	MAJOR ISSUES CASE 3 (LF-1E LOCATION)	DIFFERENCES BETWEEN CASES 2 AND 3
B. ENGINEERING			
	° approximately \$20 million less capital costs and \$1.5 million less 10-year operating cost ° longer landfill life possible	° greater capital and operating costs ° shorter landfill life because treatment plant must also be accommodated	° clear preference for Case 2 with regard to engineering

In the site vicinity, Case 2 is also preferred. There is no clear preference for impacts on residents. Case 2 (PI-27E) is more desirable for land use and potential agricultural impacts. Case 2 is clearly preferred because of the more compatible existing and future industrial lands near PI-27E. Existing and anticipated air quality is better at LF-1E, resulting in a preference for Case 3. However, impacts on air quality are expected to be extremely minor and well within provincial standards and guidelines. Therefore, based on the more highly ranked future land use and agricultural factors, Case 2 is preferred.

The Case 2 operation is considerably less costly than Case 3 (over $20 million less) and would enable a longer landfill life.

Overall, Case 2 is preferred for all factor groupings. Therefore, PI-27E is the most desirable location for the treatment plant.

The detailed cross-check by factor and factor grouping and the quantitative aggregation support the conclusions reached through the review of issues and tradeoffs. Case 2 is favoured for transportation risk, impacts on residents, future land use, agriculture, natural environment and engineering. No preference was identified for air quality risks and community and recreation features impacts. The only grouping favouring the separate incinerator was air quality impacts which is considered of minor importance.

7.6.3 LF-4N/PI-13N

Site PI-13N is the preferred location for the physical/chemical treatment plant. Table 7.8, outlines the detailed issues and tradeoffs identified in step one of the application of factors. Table F.6 in Appendix F documents the step two cross-check aggregation of factors by factor grouping and the quantitative aggregation.

Table 7.8

ISSUES AND TRADEOFFS
LOCATION OF THE PHYSICAL/CHEMICAL TREATMENT PLANT
LF-4N/PI-13N

FACTOR GROUPING/ STUDY AREA	MAJOR ISSUES CASE 2 (PI-13N LOCATION)	MAJOR ISSUES CASE 3 (LF-4N LOCATION)	DIFFERENCES BETWEEN CASES 2 AND 3
A. RISK			
Transportation	° Case 2 has lower risks to all receptors due to potential spills and accidents as a result of the differences in the number of trucks using Britannia Road between the two site entrances	° Case 3 has higher risks to all receptors due to potential spills and accidents	° Case 2 is preferred over Case 3 for transportation risk
Air Quality	° risks to existing populations for chronic emissions favour Case 2; two indicators for risks from consumption of crops and livestock and one indicator for risks from acute emissions favour Case 2	° risks to future population for chronic emissions, 3 indicators for acute emissions and ingestion of cistern and pond water favour Case 3	° clear preference for Case 3 for air quality risk

Table 7.8

ISSUES AND TRADEOFFS
LOCATION OF THE PHYSICAL/CHEMICAL TREATMENT PLANT
LF-4N/PI-13N

FACTOR GROUPING/ STUDY AREA	MAJOR ISSUES CASE 2 (PI-13N LOCATION)	MAJOR ISSUES CASE 3 (LF-4N LOCATION)	DIFFERENCES BETWEEN CASES 2 AND 3
B. IMPACTS			
Site	° planned and proposed land use is incompatible with treatment plant	° planned and proposed land use is incompatible with treatment plant	° no difference for on-site future land use
	° Case 2 affords greater opportunity to avoid biological resources	° less opportunity to avoid biological resources	° Case 2 preferred for displacement of natural features
Site Vicinity	° greater potential noise impacts on residents but lower impacts overall to 1000 m from site	° lower noise impacts on residents but greater overall impacts to 1000 m from site	° no preference for impacts on residents
	° agricultural resources for LF-4N and PI-13N are similar	° agricultural resources for LF-4N and PI-13N are similar	° minor agricultural differences
	° restraints to dispersion are less for PI-13N	° existing and anticipated air quality is better for LF-4N	° no air quality impacts preference
	° designated agricultural residential cluster near PI-13N would already be impacted by incinerator	° designated agricultural	° no clear preference for planned and proposed land use

Table 7.8

ISSUES AND TRADEOFFS
LOCATION OF THE PHYSICAL/CHEMICAL TREATMENT PLANT
LF-4N/PI-13N

FACTOR GROUPING/ STUDY AREA	MAJOR ISSUES CASE 2 (PI-13N LOCATION)	MAJOR ISSUES CASE 3 (LF-4N LOCATION)	DIFFERENCES BETWEEN CASES 2 AND 3
B. IMPACTS			
Access Roads	° slightly higher noise impacts and transportation impact indices for residents (839 residents in noise impact zone; indices are 455.6 - adjacent and 381.3- vicinity	° noise and transportation impact indices are lower for residents (744 residents in noise impact zone and indices are 452.3 - adjacent and 373.1 - vicinity)	° Case 3 preferred for impacts on residents
	° slightly greater impacts on community and recreation features within 800 m of roads	° slightly greater impacts on community and recreation features adjacent to roads	° no clear preference for impacts on community and recreation features
	° agriculture along access roads and agricultural vehicle use similar for LF-4N and PI-13N	° agriculture along access roads and agricultural vehicle use similar for LF-4N and PI-13N	° minor differences in transportation impacts on agriculture
	° less potential impact on downstream fisheries when the landfill is separate	° greater potential impact on fisheries when the incinerator is separate	° preference for Case 2 for fisheries

Table 7.8

ISSUES AND TRADEOFFS
LOCATION OF THE PHYSICAL/CHEMICAL TREATMENT PLANT
LF-4N/PI-13N

FACTOR GROUPING/ STUDY AREA	MAJOR ISSUES CASE 2 (PI-13N LOCATION)	MAJOR ISSUES CASE 3 (LF-4N LOCATION)	DIFFERENCES BETWEEN CASES 2 AND 3
C. ENGINEERING			
	° Case 2 considerably less costly than Case 3; approximately $15 million less capital costs and $1.5 million less 10-year operating costs)	° Case 3 greater capital and operating costs	° Case 2 clearly preferred for cost
	° landfill life potentially longer for Case 2	° locating the incinerator and landfill together reduces landfill life potential	° Case 2 preferred for extending landfill life

Case 2 is preferred for transportation risk. Case 3 is favoured for air quality risks. Since the transportation risk factors are ranked more highly than the air quality risks (3 versus 1), Case 2 is favoured.

The impact issues and tradeoffs indicate only subtle differences between the options. Case 2 is preferred for on-site impacts based on the limited potential for additional natural features displacement - a low ranked factor. There is no clear preference for any factor groupings in the site vicinity study area. For access routes, Case 3 is marginally preferred overall and specifically for residents, a highly ranked factor. Case 3 also is preferred for potential fisheries impacts, (a moderately ranked factor) because more streams are crossed when the incinerator and physical/chemical treatment plant are located together. There is no preference for the remaining factor groupings.

Case 2 is clearly preferred for cost (approximately $15 million difference). It also enables a longer landfill life.

In summary, the risk and impact factors indicate minor differences between the alternative locations for the physical/chemical treatment plant. Case 2 is favoured for risk and on-site impacts, although the difference between the options is not great. Case 3 is marginally preferred for the access roads study area. However, a significant difference is apparent for costs (approximately a $15 million difference). Given the minor risk and impact differences, the cost consideration takes on greater importance. Therefore, overall, Case 2 is preferred for LF-4N/PI-13N.

The cross-check factor aggregation by factor grouping supports the conclusion reached in the review of issues and tradeoffs. The transportation factors favour Case 2 and are ranked higher than air quality. Therefore, Case 2 is marginally preferred for risk. The residents impact factors marginally favour Case 3, based on access road impacts, and are highly ranked. The only other clear preference with regard to impacts is natural environment which favours Case 2 and is ranked lower than for residents.

Again, there are only subtle risk and impact differences. As a result, greater importance is attached to the engineering factors which clearly favour Case 2.

7.6.4 LF-4N/PI-1N

Site PI-1N is the preferred location for the physical/chemical treatment plant. Table 7.9, outlines the detailed issues and tradeoffs identified in step one for risks, impacts and engineering concerns. Table F.7 in Appendix F documents the cross-check aggregation of factors by factor grouping and the quantitative aggregation cross-check.

The review of issues and tradeoffs indicates only marginal differences between the alternatives for the treatment plant. There is a minor preference for Case 2.

There is little risk difference between Case 2 and Case 3. The highly ranked transportation factors marginally favour Case 2. Air quality factors, which are ranked lower, favour Case 3.

Case 2 is preferred for on-site impacts based only on the moderately ranked natural environment features displacement. The agricultural factors for the site vicinity indicated a preference for Case 2. All other factors indicate no preference. Noise impacts on residents along access roads favour Case 3. Potential agricultural, community and recreation features, and fisheries road impacts favour Case 2. Both residents and agriculture factors are ranked highly. Community and recreation features are ranked at

Table 7.9

ISSUES AND TRADEOFFS
LOCATION OF THE PHYSICAL/CHEMICAL TREATMENT PLANT
LF-4N/PI-1N

FACTOR GROUPING/ STUDY AREA	MAJOR ISSUES CASE 2 (PI-1N LOCATION)	MAJOR ISSUES CASE 3 (LF-4N LOCATION)	DIFFERENCES BETWEEN CASES 2 AND 3
A. RISK			
Transportation	° Case 2 preferred for risk due to spills based on differences in surface water risks; and risk to population	° Case 3 marginally preferred for user risk due to accidents and spills	° Case 2 marginally preferred for transportation risk
Air Quality	° risks from consumption of crops and livestock and ingestion of cistern and pond water favour Case 2	° definite preference for Case 3 for acute emissions which are considered as the most important air quality factors	° preference for Case 3 because acute emissions ranked most highly

Table 7.9

ISSUES AND TRADEOFFS
LOCATION OF THE PHYSICAL/CHEMICAL TREATMENT PLANT
LF-4N/PI-1N

FACTOR GROUPING/ STUDY AREA	MAJOR ISSUES CASE 2 (PI-1N LOCATION)	MAJOR ISSUES CASE 3 (LF-4N LOCATION)	DIFFERENCES BETWEEN CASES 2 AND 3
B. IMPACTS			
Site	° agricultural land use designation incompatible with OWMC facility	° primarily agricultural designation incompatible with OWMC facility	° no preference for planned and proposed land use on-site
	° Case 2 affords greater opportunity to avoid biological features	° Case 3 affords less opportunity to avoid biological features	° Case 2 preferred in order to avoid biological features
Site Vicinity	° Case 2 has a greater number of residents within the noise impact zone around the site but fewer residents potentially impacted within 1000 m	° Case 3 has a lower number of resident within the noise impact zone around the site but more residents potentially impacted within 1000 m	° no preference for residents in the site vicinity; noise impact and impacts within 1000 m ranked equally
	° farm operations less viable for Case 2 (fewer headquarters, greater fragmentation, more non-farm land) for PI-1N)	° farm operations more viable for Case 3 (LF-4N)	° Case 2 preferred with regard to agriculture surrounding the sites
	° air quality is the same for LF-4N and PI-1N		° no preference for existing and anticipated air quality

Table 7.9

ISSUES AND TRADEOFFS
LOCATION OF THE PHYSICAL/CHEMICAL TREATMENT PLANT
LF-4N/PI-1N

FACTOR GROUPING/ STUDY AREA	MAJOR ISSUES CASE 2 (PI-1N LOCATION)	MAJOR ISSUES CASE 3 (LF-4N LOCATION)	DIFFERENCES BETWEEN CASES 2 AND 3
B. IMPACTS			
Site Vicinity (cont'd)	° rural/agricultural land use designations	° rural/agricultural land use designations	° no preference for future land use
Access Roads	° Case 2 has a greater number of residents within noise impact zone (740) but lower impact indices for residents adjacent to and within 800 m of the access route (431.6 for adjacent and 285 for 800 m)	° Case 3 has a lower number of residents within the noise impact zone for the access routes (694) but a marginally higher number adjacent to and within 800 m of the access routes (indicates are 432.5 and 286.0, respectively)	° greatest difference between alternatives for noise impact on residents; impact indices to 800 m show only minor differences, therefore Case 3 preferred
	° impact index for adjacent community and recreation features is 14.4	° impact index for adjacent community and recreation features is 15.7	° slightly higher impact index for community and recreation features adjacent to access roads for Case 3
	° disruption of farm operations and machinery is marginally less for Case 2	° slightly greater impacts on farms and farm vehicles for Case 3	° Case 2 is marginally preferred over Case 3 for access route agricultural impacts
	° less potential impact expected on fisheries when treatment plant located with incinerator	° greater potential impacts on fisheries expected when the incinerator is separate	° preference for Case 2 for fisheries

Table 7.9

ISSUES AND TRADEOFFS
LOCATION OF THE PHYSICAL/CHEMICAL TREATMENT PLANT
LF-4N/PI-1N

FACTOR GROUPING/ STUDY AREA	MAJOR ISSUES CASE 2 (PI-1N LOCATION)	MAJOR ISSUES CASE 3 (LF-4N LOCATION)	DIFFERENCES BETWEEN CASES 2 AND 3
C. ENGINEERING			
	° Case 2 favoured with regard to costs (approximately $17,000,000 less capital cost and $1.3 million less 10-year operating cost)	° Case 3 more costly than Case 2	° Case 2 is marginally preferred over Case 3 for access route agricultural impacts
	° landfill life longer when landfill is separate	° landfill life less when landfill located with treatment plant	° Case 2 clearly preferred for cost and landfill life potential

a low level and fisheries are ranked at a moderate level. Therefore, there is a marginal preference for Case 2, based on the agricultural, community and recreation features, and fisheries impacts along access roads.

The engineering factors, again, clearly favour Case 2. An approximately $17 million lower cost and longer landfill life are expected for PI-1N.

In summary, the risk and impact factors indicate only subtle differences between Cases 2 and 3. A marginal preference for Case 2 is indicated by the site, site vicinity and access roads impacts. This preference is strongly supported by the engineering factors. A cost reduction of over $17 million was expected for Case 2. Therefore, overall, Case 2 is the preferred option.

The step two cross-checks also result in a preference for Case 2. A marginal risk preference for Case 2 occurs based on the highly ranked transportation factors. Potential impacts on community and recreation features, agriculture and natural environment also favour Case 2. Case 3 is marginally preferred only with regard to residents.

Overall, the risk and impact study components marginally favour Case 2. The high capital costs (approximately $17 million) of Case 3 substantiate and strengthen the arguments in favour of Case 2 separate landfill at LF-4N.

7.6.5 CONCLUSIONS AND RECOMMENDATIONS

Two options are available for the location of the physical/chemical treatment plant for partially integrated siting options, either with the incinerator or with the landfill site. The preferred locations were determined by comparing the options based on risk, impact and engineering factors. The methodology included the screening, ranking and aggregation of factors. Two cross-checks of the results were also undertaken.

In each of the three cases under consideration (LF-1E/PI-27E, LF-4N/PI-13N and LF-4N/PI-1N), the preferred location for the treatment plant is with the incinerator (PI) site-Case 2.

8.0 BASIC ACCEPTABILITY ANALYSIS

8.1 INTRODUCTION

As noted in Chapter 2 the Phase 4A site selection process is divided into two streams of analysis. The Basic Acceptability analysis and the comparative evaluation process. The Basic Acceptability analysis determines whether major new constraints would preclude the use of a site(s) irrespective of it relative suitability.

It was expected that few (if any) sites would be identified which were basically unacceptable. Clearly unsuitable areas and sites had largely been excluded during previous stages of the site selection process. Few siting factors possessed well defined thresholds of acceptability. Risk and impact predictions are also rarely sufficiently precise nor is there sufficient certainty regarding mitigation to warrant the rejection of a site based on a single constraint.

Consistent with the ranking of the three site selection goals, particular emphasis in the basic acceptability analysis was placed on severe potential risks and impacts.

Section 8.2 provides an overview of the general approach taken to the Basic Acceptability analysis. Section 8.3 describes the review and screening of a series of potential exclusionary factors. The remaining factors are then applied to the candidate sites in Section 8.4.

8.2 APPROACH

The Basic Acceptability analysis was directed toward situations where a site was clearly unsuitable, i.e. a well-defined threshold of acceptability, where there was limited uncertainty regarding the data base or its interpretation, and where the potential for mitigation appeared limited. Where there was doubt regarding the potential acceptability of a site, it was retained for consideration in the detailed comparative analysis.

In order to expedite the Phase 4A site selection process, the Basic Acceptability analysis was undertaken in parallel with the Refinement and Comparison of Siting Options. The two activity streams were interrelated in a number of important respects, notably:

- if a site was determined to be basically unacceptable, it was dropped from the comparative evaluation process;
- siting option refinement decisions, particularly boundary refinement, influenced the acceptability of certain sites;
- site-specific mitigative measures introduced to overcome Basic Acceptability constraints influenced the relative suitability of siting options;
- site-specific design modifications introduced to overcome relative suitability constraints had implications for the Basic Acceptability analysis.

Throughout the Phase 4A site selection process an effort was made to ensure that the Basic Acceptability and Comparative Evaluation activity streams were consistent and mutually supportive.

Table G.1 in Appendix G highlights some of the criteria for site rejection suggested by communities and groups through the OWMC public consultation program. The site selection team's response to each of these concerns is also provided in Table G.1. A much longer list of concerns were raised, which local communities and groups suggested should reduce the relative suitability of the candidate sites. These concerns are addressed in Volume 2 as part of the detailed comparative evaluation process. In addition, data and interpretation were drawn where needed from such other OWMC activities as technology evaluation and the waste quantities analyses.

The Basic Acceptability analysis is illustrated on Figure 8.1. It began with a review by each consultant of criteria warranting further consideration in the Basic Acceptability analysis. This process resulted in a preliminary list of "exclusionary" criteria. When this preliminary list was reviewed, a number of potentially "exclusionary" criteria did not to provide a sufficient basis for exclusion. The reasons why criteria were or were not screened were documented.

The one criterion retained as a result of this analysis was hydrogeologic natural containment. The application of this criterion took place in two steps - without mitigation, i.e. before design/operations modifications to overcome the constraint, and with mitigation. Separate analyses were undertaken for the landfill and the incinerator physical/ chemical treatment plant. The results of the Basic Acceptability analysis were incorporated back into the site selection process as they occurred.

8.3 REVIEW AND SCREENING OF POTENTIAL EXCLUSIONARY FACTORS

Each consultant reviewed their factors for their general potential as exclusionary criteria. They also applied each of their factors to the eight candidate sites to determine whether conditions warranted the exclusion of a site for a particular factor. As highlighted in Table 8.1, in many cases concerns warranting exclusion were addressed in previous stages in the site selection process.

The reasons considered by the consultants in addressing whether a site should or should not satisfy Basic Acceptability requirements, are noted in Table 8.2. The application of these reasons to the factor groupings (and where warranted factors) are highlighted in Table 8.3. The specific rationales for the overall conclusions of each site selection consultant, are provided in the individual consultants' technical reports.

A total of seven criteria were identified as potentially exclusionary. As indicated in Table 8.4, in all but one case, hydrogeologic natural containment, reasons were identified which warranted the retention of the site or sites affected for further consideration in the detailed comparative evaluation process.

Figure 8.1

Basic Acceptability Analysis

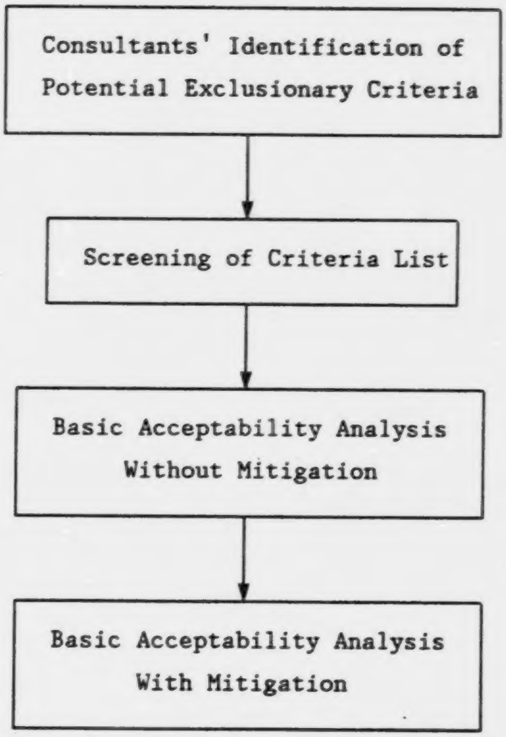
Consultants' Identification of Potential Exclusionary Criteria
Screening of Criteria List
Basic Acceptability Analysis Without Mitigation
Basic Acceptability Analysis With Mitigation

Table 8.1

Exclusionary Criteria in Previous Phases

Factor Grouping	Exclusionary Criteria
A. Risk	
° Transportation Risk	° areas outside the Golden Horseshoe area (also pertains to transportation costs) ° areas more than 30 minutes from 400 series highway ° utility transmission installations, arterial roads, railway lines ° major airport (Transport Canada licensed) (stack height restriction within 4000 m radius or along extension of a runway)
° Hydrogeologic Suitability	° areas outside zones 1 and 2 (Phase 2) ° variable geologic materials and subsurface conditions and/or less than 10 metres of silt/clay soils ° surface granular soils ° drumlins (Niagara) ° drumlin fields ° moraines ° hydrogeologically unsuitable as a result of surface features, e.g. spoil piles
° Air Dispersion/Air Quality	° areas subject to combinations of air dispersion constraints (lake breeze, topographic and urban heat island) where small area involved and no offsetting benefits

Table 8.1

Exclusionary Criteria in Previous Phases

Factor Grouping	Exclusionary Criteria
A. Risk	
° Surface Water Suitability	° stream courses ° floodplains ° wetlands
B. Environmental Impacts	
° Residents ° Community and Recreation Features	° post secondary education facility ° special educational facilities ° homes for the aged ° nursing homes ° public building (emergency function) ° theme parks ° regional shopping centres ° hospitals ° institutions for the disabled
° Land Use	° completely built up areas ° residential, designated and built upon ° residential, designated, serviced and vacant ° commercial, designated and built upon

Table 8.1

Exclusionary Criteria in Previous Phases

Factor Grouping	Exclusionary Criteria
B. Environmental Impacts	
° Land Use (cont'd)	° commercial, designated and vacant ° residential, existing rural and agricultural ° residential, designated and vacant ° Indian Reserves
° Agricultural Resources	° existing specialty crops ° Class 1 or 2 with row crops or corn-wheat[1] ° Class 1 or 2 with mixed cereal grain hay-grain or hay (good quality)[1] ° Class 3 with row crops or corn-wheat[1] ° Class 3 with mixed cereal grain, hay-grain or hay (good quality)[1] ° Class 1 or 2 hay (poor quality), pasture or grazing ° Class 4 with row crops, corn-wheat[1] ° Class 4 with mixed cereal grain, hay-grain or hay (good quality)[1]

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[1] Except for areas within industrially designated, residual, regional official plan, publicly owned lands, urban shadow and short haulage distance, where this factor is non-exclusionary.

Table 8.2

Reasons for Exclusion or Retention

Potential Reasons For Exclusion	Potential Reasons for Retention
° direct conflict with public requirements, regulations, policies, criteria or guidelines ° basic conflict with OWMC policies or principles ° site cannot meet basic engineering requirements even after mitigation ° unique or extremely rare or extremely significant (generally recognized) loss of feature or resource; would represent major loss - irreplaceable feature or resource ° severe (in an absolute sense) directly and non-mitigable risk or impact ° well defined threshold with limited uncertainty regarding choice of threshold, magnitude of impacts or risks, significance of resource and feature, and potential for mitigation	° no direct conflict with public requirements, regulations, policies, criteria or guidelines ° no applicable requirements, regulations, policies, criteria or guidelines ° policy or guideline conflict not major and/or potential for modification, e.g. official plan designations ° no basic conflict with OWMC policies or principles ° site satisfies basic engineering requirements ° unique, extremely rare or significant features excluded during previous site selection stages ° impacts or risks not severe ° impacts or risks potentially mitigable ° threshold not well defined, e.g. options clustered close together ° uncertainty regarding impact/risk magnitude ° uncertainty regarding resource/feature significance ° potentially mitigable

Table 8.2

Reasons for Exclusion or Retention

Potential Reasons For Exclusion	Potential Reasons for Retention
	° within generally accepted standards ° very low potential of occurrence ° moderate to low severity of potential risks/impacts

Table 8.3

BASIC ACCEPTABILITY SCREENING

	PUBLIC POLICY, REQUIREMENTS, GUIDELINES, ETC.						OWMC POLICIES, PRINCIPLES, REQUIREMENTS				SIGNIFICANCE				SEVERITY								COMMENTS
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
A. RISK																							
• Transportation (spills)			0					0									0		0		0	0	• options clustered relatively close together
• Transportation (airport conflict)	X																	0					• likelihood of human exposure very limited • potential navigational conflict with the Burlington Airpark for stack location on portion of PI-1H
• Transportation (accidents)			0					0							X		0		0				• options clustered relatively close together
• Air Quality (chronic)				0	0			0														0	• within applicable standards and guidelines
• Air Quality (acute)			0		0			0									0	0	0		0	0	• likelihood of human exposure very limited
• Surface Water Suitability (flood Susceptibility)	X			0			X								X		0	0	0	0	0		• flood potential on site LF-3C; potentially mitigable and some uncertainty re severity; well-defined flood prone areas excluded in previous stages
• Surface Water Suitability (water use)			0					0									0	0				0	• indirect and mitigable risks; major sensitive uses screened in previous stages
• Hydrogeology (natural containment)		0					X								X	X	0			0			• some sites potentially fail to ensure natural containment
• Hydrogeology (ground water use)		0						0										0	0			0	• moderate to low risk providing adequate natural containment
B. IMPACTS																							
• **Site**																							
• Residents			0					0									0	0	0	0		0	• major impacts addressed in previous stages; not major differences among options; potentially mitigable
• Businesses			0					0									0	0	0	0		0	• as above
• Community and Recreation Facilities			0					0									0	0	0			0	• as above
• Land Use						0		0									0	0	0			0	• as above
• Agriculture	X							0					0				0		0			0	• may not be considered consistent with Foodland guidelines; impact moderate
• Archaeological Resources	X							0						0	X		0	0	0	0			• potentially severe on one site, LF-3C, potentially mitigable
• Natural Environment			0					0					0	0			0	0	0	0		0	• moderate impacts anticipated; major concerns addressed in previous stages
• **Site Vicinity**																							
• Residents			0					0									0	0	0	0		0	• major impacts addressed in previous stages; some potential for mitigation; options quite close together; moderate impacts
• Businesses			0					0									0	0	0	0		0	• as above
• Community and Recreation Features			0					0									0	0	0	0		0	• as above
• Land Use						0		0									0	0	0	0		0	• as above
• Agriculture			0					0					0				0	0	0	0		0	• as above
• Natural Environment			0					0					0				0	0	0	0		0	• as above
• Air Dispersion/Air Quality					0			0									0	0				0	• well within standards; limited effects anticipated
• **Access Roads**																							
• Residents			0					0									0		0	0		0	• most severe impacts addressed in previous stages; some potential for mitigation
• Community and Recreation Features			0					0									0		0	0		0	• as above
• Land Use			0					0									0	0	0	0		0	• as above
• Agriculture			0					0									0	0	0	0		0	• as above
• Natural Environment			0					0									0		0	0		0	• as above
• **Community and Regional** • **Access Roads**																							
• Residents			0					0									0		0	0		0	• most severe impacts addressed in previous stages; some potential for mitigation
• Community and Recreation Features			0					0									0		0	0		0	• as above
• Land Use			0					0									0	0	0	0		0	• as above
• Agriculture			0					0									0	0	0	0		0	• as above
• Natural Environment			0					0									0		0	0		0	• as above
• **Community and Regional**																							
• Municipal Finance and Services			0					0										0		0		0	• OWMC commitment; no negative impacts; one option potentially negative impacts (LF-4H/PI-1H)
• Social Cohesion, Social Stability and Community Character			0					0										0	0	0			• thresholds not well-defined; mitigation potential; uncertainty re severity
• Economic Base		0						0										0	0	0		0	• as above
• Tourism Economy		0						0										0	0	0		0	• as above
• Tourism Operators		0						0										0	0	0		0	• as above
• Land Use		0						0										0	0	0		0	• as above
• Agriculture		0						0										0	0	0			• as above
C. ENGINEERING																							
• Site Area			0														0	0					• one site, LF-9C, initially failed to meet technical buffer zone requirements
• Cost			0					0											0			0	• limited differences among options
• Flexibility			0					0										0	0			0	• flexibility desirable, but not absolute requirement

LEGEND

X Potentially exclusionary
0 Reason why may not be exclusionary

1. Direct conflict
2. No direct conflict; potentially consistent
3. No applicable policies or requirements
4. Within applicable policies or requirements
5. Within generally acceptable standards (other jurisdictions)
6. Potential for changing policies
7. Direct conflict with policies or priorities
8. No direct conflict
9. May not satisfy basic engineering requirements
10. Satisfies basic engineering requirements
11. Unique, extremely rare, highly significant
12. Major permanent resource loss
13. Moderate absolute significance
14. Uncertainty regarding significance
15. Severe, direct, non-mitigable risks and impacts
16. Well-defined threshold with limited uncertainty
17. Severe impacts or risks largely addressed during previous site selection stages
18. Potentially mitigable
19. Threshold not well-defined or options clustered quite close together
20. Uncertainty regarding severity
21. Very low probability of effects
22. Moderate to low severity or potentially positive effects

Table 8.4

Treatment of Potentially Exclusionary Considerations

Factors	Reasons Why Potentially Exlusionary	Conclusions/Reasons
° Transportation - Airport Conflict	° western two-thirds of PI-1N falls within a 4000 m navigational area for Burlington Air Park ° transportation consultant determined that a stack height of greater than 40 m would represent a serious navigational conflict with the airport ° would conflict with Federal guidelines ° could affect licence and/or expansion potential of airport	° do not exclude PI-1N because boundaries refined such that stack placement would be within the eastern one third of PI-1N which was beyond 4000 m navigational area
° Surface Water Suitability - Flood Susceptibility	° flood susceptibility represents a severe potential risk ° flood susceptibility would conflict with provincial requirements and would be inconsistent with OWMC natural containment principle ° a portion of LF-3C is susceptible to flooding	° do not exclude LF-3C because flood susceptible portion of site excluded from site development purposes during boundary refinement ° with a 200 m setback from Beaver Creek for site development purpose, flood susceptibility concern viewed as mitigable

Table 8.4

Treatment of Potentially Exclusionary Considerations

Factors	Reasons Why Potentially Exlusionary	Conclusions/Reasons
° Hydrogeology - Natural Containment	° a site which fails to ensure natural containment would be inconsistent with OWMC second level of protection principle ° could represent long-term risk to human health ° engineering analysis revealed (see Monenco, 1986) that active engineering for both the landfill and the incinerator/physical/ chemical treatment plant could not assure that off-site containment releases would not occur ° not possible to quantify leachate quality based on available leachate characteristics data ° variability in dilution capabilities of aquifers and in attenuation capabilities of soil; not possible to calculate attenuation capabilities in soils without site specific geochemical data and detailed data on chemical nature of wastes and waste residues ° will not know precise characteristics of leachate and of waste until the facility has been operating for a period of years	° treat as exclusionary in basic acceptability analysis with specific reference to: - mitigation potential - containment/no containment - adequacy of containment - applied to both landfills and incinerator/ physical chemical treatment plant sites

Table 8.4

Treatment of Potentially Exclusionary Considerations

Factors	Reasons Why Potentially Exlusionary	Conclusions/Reasons
° Hydrogeology - Natural Containment (cont'd)	° will not have data on natural ground water quality at sites until Phase 4B detailed drilling ° hydrogeologic consultants (Gartner Lee Associates) concluded that reliance should not be placed solely on dilution in an aquifer or in attenuation of soils to reduce leachate characteristics or waste characteristics to an acceptable level ° provision of permanent alternative water supplies not viewed as effective long term strategy for minimizing risk ° recognized that OWMC cannot ensure complete control over the use of an aquifer by adjacent property owners ° Phase 4A hydrogeologic investigations identified a number of sites (LF-2N, LF-4N, PI-1N, PI-13N) with either the potential for direct discharge of contaminants into an aquifer or where natural containment is limited	

Table 8.4

Treatment of Potentially Exclusionary Considerations

Factors	Reasons Why Potentially Exlusionary	Conclusions/Reasons
° Agriculture	° some sites involve development on CLI capability classes 1-4; potentially inconsistent with Ontario Foodland Guidelines	° do not exclude sites because Foodland Guidelines represent a process for decision-making; necessary to justify why can't be on lower capability land. Reasons why should continue to consider higher capability lands include: - specialty crops and highest capability lands excluded during previous stages - highest quality farm operations excluded during previous stages - small area of land involved - off-site risks to crops appear to be minimal (see Environ, 1985) - off-site impacts on agriculture appear to be moderate although some uncertainty regarding magnitude and duration of impacts - rejection of site might result in restriction of site selection process to sites with much higher relative and absolute risks and impacts in other areas, e.g. hydrogeologic suitability; need to consider as part of comparative evaluation

Table 8.4

Treatment of Potentially Exclusionary Considerations

Factors	Reasons Why Potentially Exlusionary	Conclusions/Reasons
° Archaeological Resources	° major concentration of archaeological resources along Beaver Creek on LF-3C siting option ° severe potential impact may not be mitigable	° do not exclude LF-3C because boundary refinement process led to a 200 m development setback from Beaver Creek ° development setback meant that all but a small number of minor resources no longer impacted ° remaining resources mitigable ° OWMC commitment to mitigate
° Site Area Requirements	° modular facility design for LF-9C would mean that 400 metre buffer zone from central operating area would extend beyond site boundaries ° 400 metre technical buffer zone within site boundary treated as basic requirement in site selection process	° do not exclude LF-9C - site specific layout for LF-9C (see Volume 2 Chapter 4) resulted in 400 metre buffer being retained within site boundary
	° after modified design (see Monenco, 1986) with total solidification, landfill lives for LF-9C (14 years), LF-1E (12), LF-4N/PI-13N (15.5), LF-4N/PI-1N (15.5) all less than 20 years	° do not exclude sites because landfill design not optimized. With optimization, potential for extension in site life; in addition, significant uncertainty in specific landfill lives, which will vary with landfill type, mode of effluent disposal, rate of incoming waste and type of waste received.

8.4 APPLICATION OF BASIC ACCEPTABILITY ANALYSIS

8.4.1 INTRODUCTION

As noted above, the only criterion fully applied in the Basic Acceptability analysis was natural containment. This criterion was applied to both landfills and to incinerator/physical/chemical treatment plant sites.

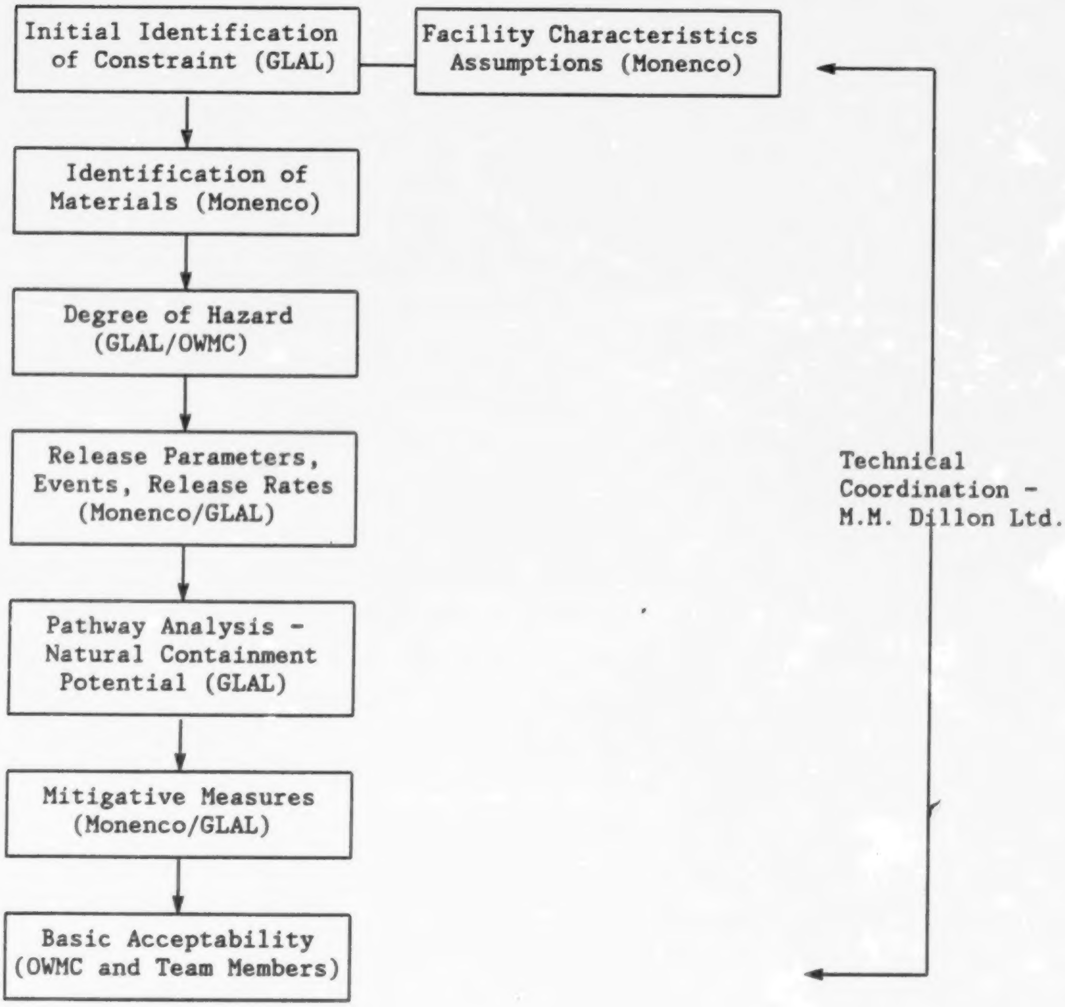
8.4.2 PROCESS

The Basic Acceptability analysis involved a number of consultants, as illustrated in Figure 8.2, under the coordination of Dillon Site Selection. The process began with the identification of a major constraint by the hydrogeologic consultant - Gartner Lee Associates Ltd. The constraints identified by Gartner Lee Associates were largely based on the data obtained during Phase 4A from a preliminary drilling program. The constraints identified by Gartner Lee Associates were, in part, dependent on the facility characteristics assumptions supplied by Monenco Ltd. Of particular relevance was the proposed layout of the facility components on the site and the proposed excavation depths.

Through the course of the Phase 4A analysis, Gartner Lee Associates Ltd. identified constraints on several candidate sites. Monenco Ltd. developed a list of potential events, however unlikely, in which liquid contaminants could be released. These scenarios concerned such matters as the quantity and type of the release, its location on the site based on the proposed layout of the facility components. Consideration was given to both short and long-term releases. The range of release situations were identified and provided to Gartner Lee Associates (Monenco, 1986).

Figure 8.2

Basic Acceptability Analysis Process - Natural Containment


Initial Identification of Constraint (GLAL)
Facility Characteristics Assumptions (Monenco)
Identification of Materials (Monenco)
Degree of Hazard (GLAL/OWMC)
Release Parameters, Events, Release Rates (Monenco/GLAL)
Pathway Analysis - Natural Containment Potential (GLAL)
Mitigative Measures (Monenco/GLAL)
Basic Acceptability (OWMC and Team Members)
Technical Coordination - M.M. Dillon Ltd.

In the case of the landfill, as previously noted, it is not possible to precisely determine the leachate characteristics. It is also not possible to anticipate fully the composition and toxicity of potential contaminants which might be released at the physical/chemical treatment and incineration facilities. The Gartner Lee report indicates that, "contaminants could range from untreated waste to very dilute treated effluents". In addition, the absence of site specific geochemical data, together with the uncertain "chemical nature of the untreated wastes and treated waste residues", made it impossible to justify calculations of the attenuation potential of the soils or the dilution potential of the aquifers. Such data would only be available when detailed design and drilling were undertaken and, in the case of precise leachate characteristics, only after a period of years of operations. The following conservative assumptions were, therefore, made regarding the degree of hazard associated with the materials which might potentially be released:

- leachate quality would not necessarily satisfy regulatory requirements and could pose a threat to the environment if released directly into an aquifer;
- the material released from the central operating area; (see Monenco, 1986) would be potentially hazardous;
- soil attenuation to an acceptable level could not be assumed;
- aquifer dilution to an acceptable level could not be assumed.

The Monenco analysis of events identified that complete reliance could not be placed on "active engineering" to prevent contaminant releases in the case of both the landfill and the incinerator/physical/chemical treatment plant. From the Monenco list of possible contaminant sources for the central operating area (of the Physical/Chemical Treatment Plant/ Incinerator), Gartner Lee Associates identified two contaminant release scenarios considered applicable for preliminary assessment of contaminant transport: 1) a (short-term) spill residual scenario (assumes a tanker truck overturns and spills its contents); and 2) a (long-term) subsurface leak scenario from a storage tank. In the case of the latter, it was assumed for modelling purposes that the leak could occur over the lifespan of the facility and would remain undetected until decommissioning of the facility.

In the case of the landfill, a further series of conservative assumptions were employed for modelling purposes. These assumptions, together with a more complete description of the assumptions employed in the analysis of the incinerator/physical/chemical treatment plant sites, are contained in Geologic, Hydrogeologic and Geotechnical Considerations (GLAL, 1985b). Excavation depths for the landfill and the incinerator/physical/chemical treatment plant were assumed to be 10 m and 8 m, respectively.

The Gartner Lee report notes, "because of the uncertain chemical nature of untreated wastes and treated waste residues, the analytical calculations in this assessment are based strictly on relative contaminant concentrations" (GLAL, 1985b, p. A-10). The time at which peak relative concentrations occurred was identified as the breakthrough time. Contaminant breakthrough times, together with hydrogeologic interpretation of predictability of geologic conditions, were employed to assess the capability of each site to provide natural containment.

If it appeared that a site might not provide natural containment, site-specific modifications to the site design which could be used to mitigate potential concerns were undertaken by Monenco. These modifications included adjustments in the depths of excavation and in the placement of facilities on site. Once these changes were made, Gartner Lee recalculated breakthrough times and considered again the predictability of geologic conditions. This formed the basis for conclusions and recommendations submitted from pertinent members of the site selection team to OWMC.

The initial investigations by Gartner Lee Associates identified four sites - LF-4N, LF-2N, PI-1N and PI-13N - potentially constrained with respect to capability to provide natural containment.

8.4.3 LF-2N

The hydrogeologic analysis of LF-2N revealed that the excavation for the landfill (to a depth of 10 metres) would directly intersect with the aquifer. In effect, this meant that the site would not provide a second level of protection. Leachate from the landfill could be expected to discharge directly into the underlying aquifers without the benefits of attention afforded by the confining layer (GLAL, 1985b).

In an effort to overcome this constraint, the design of the landfill was modified to limit the excavation depth to 5 m. It is noteworthy that the upper 5 m of the confining layer of LF-2N can be expected to provide only minimal containment, with respect to vertical contaminant movement, because of natural fracturing. Thus, an excavation depth of less than 5 m would be expected to be of limited additional benefit (GLAL, 1985b).

The modifications to the landfill excavation depth did not, however, enhance the natural containment potential of LF-2N. The Gartner Lee report indicates that, "The lower part of the confining layer at LF-2N displays lateral and vertical textural variability which results in some uncertainty in the interpretation of confining layer thickness. Even with the above - ground design (where solidified product is placed above ground), leachate could be expected to enter the underlying aquifer without the benefits of attenuation afforded by the confining layer" (GLAL, 1985b).

Because the site was not considered capable of providing natural containment, the consultants involved in the analysis recommended that LF-2N be dropped from further consideration. A more detailed description of the application of the basic acceptability screen at LF-2N is contained in an interim report entitled, Site Selection Process Phase 4A: Selection of a Preferred Site(s) Interim Site Selection Report, Candidate Site LF-2N (M.M. Dillon Limited, 1985a). Reference should be made to the reports of Gartner Lee (GLAL, 1985b) and Monenco (Monenco, 1986) for a more detailed description of the hydrogeologic and engineering inputs, respectively, in the basic acceptability analysis for LF-2N.

8.4.4 LF-4N

The landfill[1] hydrogeologic analysis of LF-4N, indicated that the confining layer would not be completely penetrated by a 10 m deep excavation. Hence, it was concluded that the site did offer some natural containment. With contaminant breakthrough times ranging from 1 to 68 years, however, there were serious concerns regarding the natural containment provided. Inasmuch as the interpretation of breakthrough times were based on a preliminary drilling program, there was also some concern regarding whether a more detailed drilling program, as proposed for Phase 4B, might identify conditions which would mean that effectively the site offered negligible natural containment.

It was, therefore, decided to attempt to enhance the natural containment potential of LF-4N through design modifications. By raising the excavation depth for the landfill cells from 10 m to 5 m, and by limiting development to just those portions of the site where the confining layer exceeds 15 m, the range in breakthrough times was raised from 1 to 68 years to 57 to 150 years.

The confining layer of LF-4N is uniform, and laterally and vertically continuous. The confining layer is also, however thin, resulting in relatively rapid breakthrough times (GLAL, 1985b).

---

[1] It was determined in Phase 3B that LF-4N was not suitable for an incinerator. As indicated in Chapter 7 of this volume it was determined that it would be preferable to place the physical/chemical treatment plant at PI-1N with the LF-4N/PI-1N siting option.

On the basis of the above, although the natural containment potential of LF-4N was characterized as marginal, it still provides sufficient containment following mitigative design modifications such that the site is basically acceptable. This conclusion also recognizes the conservative assumptions employed in the analysis. Finally, LF-4N possesses significant advantages for other factors, notably overall transportation risk. Thus, in a comparison, the hydrogeologic limitations associated with the site could be more than offset by a combination of advantages with respect to other risk, impact and cost considerations.

8.4.5 PI-13N

As previously noted, the Monenco analysis of potential releases indicated that it might not be fully possible to clean up short-term releases. More importantly, Monenco identified the potential for small, but long-term releases, which might not be detected until after facility decommissioning. The engineering analysis incorporated an extensive series of design and operation measures to prevent, detect and clean-up such occurrences (Monenco, 1986). The contaminants at the incinerator/physical/chemical treatment plant tend to be much more hazardous than the leachate from the landfill.

In view of the above, the OWMC policy of natural containment for the incinerator/physical/chemical treatment plant is warranted in the interests of minimizing risk to human health. The PI sites were, therefore, subjected to a basic acceptability analysis comparable to that considered for the landfill sites. However, as previously noted, different contaminant release scenarios were considered for the PI basic acceptability screen.

When the basic acceptability screen was applied to PI-13N (assuming an excavation depth of 8 m), it was determined that the excavation would locally penetrate the aquifer under the subsurface leak scenario. Thus, the site does not provide natural containment.

Reducing the excavation depth below ground level for the central operating area from 8 m to 5 m did not alter the constraint identified at PI-13N. The Gartner Lee report indicates that, "The confining layer at PI-13N is generally less than 5 m in thickness and displays some local variability. The shallower 5 m excavation depth for the plant facilities would be expected to locally penetrate the confining layer". (GLAL, 1985b).

On the basis of the above, it was therefore concluded that PI-13N fails to provide natural contaminant. As a result, it is basically unacceptable. Because the conclusions regarding PI-13N were not reached until the detailed comparative evaluation was largely complete, PI-13N, in combination with LF-4N, is included in the detailed comparative evaluation.

8.4.6 PI-1N

When the basic acceptability screen was applied to PI-1N (assuming an excavation depth of 8 m), it was determined that the excavation would locally penetrate the aquifer. This would mean that, in the event of a release of contaminants, the untreated wastes, "could discharge directly into underlying aquifers without the benefits of attenuation afforded by the confining layer" (GLAL, 1985b).

By modifying the facility design it was possible to reduce the excavation depths below ground level for the central operating area to 5 m for PI-1N. It was subsequently determined that the confining layer would not be completely penetrated. Thus, the site provided some natural containment. The contaminant breakthrough, after this design modification, was however estimated to be only about 28 years based on the subsurface leak scenario.

PI-1N is, therefore, basically acceptable. From a hydrogeologic perspective the site could be characterized as marginal. As with LF-4N, the potential remains for this disadvantage to be more than offset by other relative advantages. PI-1N (in combination with LF-4N) should, therefore, be included in the detailed comparative evaluation.

8.4.7 OTHER SITES

As described in the Gartner Lee Report (GLAL, 1985b), all the remaining landfills (LF-3C, LF-9C, LF-1E) and the remaining PI site (PI-27E) are basically acceptable and were therefore retained for consideration in the detailed comparative evaluation analysis (see Volume 2 of this report).

The siting options remaining for consideration in the detailed comparative evaluation were, therefore as follows:

Milton	West Lincoln	Niagara Falls
LF-4N/PI-1N	LF-3C	LF-1E
LF-4N/PI-13N[1]	LF-9C	LF-1E/PI-27E

---

[1] As previously noted LF-4N/PI-13N was also included in the detailed comparative evaluation as PI-13N was not determined to be basically unacceptable until the detailed comparative evaluation was largely completed.

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GLOSSARY OF TERMS

1. Acceptable Daily Intake (ADI): Estimate of the largest amount of chemical to which a person can be exposed on a daily basis which is anticipated to result in no adverse effects (usually expressed in mg/kg/day).

2. access roads: Access roads refers to the roads that will be travelled by vehicles carrying special wastes, additives and reagents and intersite transfer materials (treated wastes) to and from the OWMC facilities. Preferred access roads have been chosen by the site selection team for routes from the 400 series highway to the candidate sites. The portion of the access road system from the 400 series highways to the site and the roads between sites are referred to as the local and regional access roads. The province-wide access system refers to the total access system to the candidate sites excluding the local and regional access roads.

3. acute exposure: Exposure of short duration, as opposed to chronic.

4. additives and reagents: The treatment of special wastes prior to disposal in a landfill site requires the use of reagents and additives (e.g. cement, sodium silicate, hydrated lime).

5. Adjusted Margin of Safety (AMOS): Estimate of the largest amount of chemical exposed on a daily basis which is not anticipated to result in adverse effects (usually expressed in mg/kg/day) divided by the actual amount of human exposure in a population.

6. aggregation: Aggregation refers to a numerical procedure for combining measures of importance (factor rankings with measures of risk and impact magnitude) (factor suitability levels)).

7. aggregation of factors: The process of combining all factors of a specific siting option to produce a composite siting option suitability by Factor Grouping.

8. aggregation of indicators: The process of combining all indicators for one factor to produce factor suitability levels. Indicators are aggregated for each factor for each siting option.

9. air dispersion zones: Refers to two air quality zones employed in the air quality monitoring work. The zones are 0-5 km for fugitive or low elevation releases and 0-20 km for stack emissions studies.

10. basic acceptability analysis: A step in the evaluation process that involves an assessment of the acceptability of siting options to ensure that they meet basic agency requirements and taking into consideration major new constraints identified as a result of Phase 4A data collection.

11. boundary refinement: The process of redefining site boundaries for certain candidate sites. Candidate sites PI-1N, LF-3C and LF-1E underwent boundary refinement.

12. carcinogen: A substance that increases the risk of cancer.

13. Case 1: The option of locating the physical/chemical treatment plant, the incineration plant and the engineered landfill on one site.

14. Case 2: The option of locating the physical/chemical treatment plant with the incineration plant for partially integrated siting options.

15. Case 3: The option of locating the physical/chemical treatment plant with the engineered landfill site for partially integrated siting options.

16. chronic exposure: Exposure of long term duration, as opposed to acute.

17. community and regional area: The community and regional area is the broader study area surrounding the site vicinity boundary. This was defined in various ways by the site selection consultants. The general approach used by consultants to define the study area was to use well-defined boundaries, e.g. air dispersion zones, municipalities.

18. conservative assumption: Assumptions which are conservative in the sense of overestimating possible human health risk and impacts.

19. constraints: Constraints are limitations imposed on the use of the land by a specific feature which is potentially incompatible with the siting of OWMC facilities.

20. constraint mapping: Constraint mapping is a method of analysis that involves identification of factors that may pose constraints to development, collection of data, mapping of data on "constraint maps", and the identification of areas not excluded by constraints shown on the maps. For example, this method could be used to identify the preferred location for siting a facility.

21. constant marginal utility: Constant marginal utility occurs when successive units of impact or risk are assumed to cause a constant increase in total impact or risk. This is in contrast to a situation where, for example, a threshold exists above which total impacts increase at a much faster rate for each unit of impact.

22. data matrices: Data matrices are tables recording the raw data or information collected for each siting option. The data corresponds to each factor and indicator.

23. dose: Measurement of the amount received by the subject, whether human or animal, per unit of body weight.

24. dose-response evaluation: A component of risk assessment that describes the quantitative relationship between the amount of exposure to a substance and the extent of toxic injury or disease.

25. epidemiological study: Study of human populations to identify causes of disease. Such studies often compare the health status of a group of persons who have been exposed to a suspect agent with that of a comparable nonexposed group.

26. exposure: To be accessible to the influence of a chemical or chemical action.

27. facilities characteristic assumptions: Are descriptions of key elements of the proposed undertaking.

28. factor: Each factor represents a positive or negative consideration which would assist in comparing siting options. The factors refer to risks, impacts or engineering considerations. Two examples of factors include social cohesion and capital cost.

29. factor grouping: The factor groupings are groups of factors. An example of a factor grouping would be hydrogeologic suitability. The hydrogeologic suitability factor grouping is composed of two factors - natural containment and ground water use.

30. factor ranking: In order for the site selection team to compare siting options using the factors, it is necessary to consider the relative importance of the factors. The process of establishing the relative importance of each factor is called factor ranking.

31. factor scores: The sum of the products of factor ranking and factor suitability levels.

32. factor suitability level: Is the relative level of constraint associated with a factor occurrence within a particular study area for a particular siting option.

33. feature: A feature includes all man-made structures (e.g. residences, farm complexes) and natural environmental resources located either on-site or off-site.

34. fugitive emissions: Fugitive emissions are any air pollutants emitted to the atmosphere other than from the stack (e.g. dust from trucks, and emissions escaping as drums are opened).

35. generic risk assessment: The scientific activity of evaluating the toxic properties of a chemical and the conditions of human exposure to it, both to ascertain the likelihood that exposed humans will be adversely affected, and to characterize the nature of the effects they may experience. The term generic indicates that the risk assessment has used a single set of generalized site parameters applicable to all sites rather than characteristics specific to each candidate site.

36. geographic cluster: Geographic cluster refers to the grouping of the siting options by location - Milton, West Lincoln and Niagara Falls, prior to the comparison of siting options. The siting options located within geographic cluster were compared and a preferred siting option for each geographic cluster was identified.

37. goals: The goals address broad areas of consideration in site selection and have been developed and adopted by OWMC to guide the process of identifying and evaluating candidate sites. The three goals, ranked in order of importance, are:

(i) to minimize risk to human health;
(ii) to minimize environmental impact; and
(iii) to minimize financial costs to OWMC and the people of Ontario.

38. hazard evaluation: A component of risk assessment which involves gathering and evaluating data on the types of health injury or disease (e.g. cancer) that may be produced a chemical and on the conditions of exposure under which injury or disease is produced.

39. human exposure evaluation: A component of risk assessment that involves describing the nature and size of population exposed to a substance and the magnitude and duration of their exposure. The evaluation could concern past exposures, current exposures or anticipated exposures.

40. human health risk: The likelihood (or probability) that a given exposure or series of exposures may have or will damage the health of individuals experiencing the exposures.

41. hypothetical best siting option: The hypothetical best siting option represents the sum of the best factor suitability levels across the the siting options.

42. impact: Impact refers to the effect or influence that the introduction of the OWMC facility may have. Impacts may be either positive or negative.

43. indicators: Factors are subdivided into indicators. Indicators are ways of more precisely identifying, describing and predicting risks, impacts and engineering cost concerns. Examples of indicators for the factor "surface water suitability" are downstream surface water use and transport spill entry to a stream.

44. ingestion: Type of exposure through the mouth.

45. inhalation: Type of exposure through the lungs.

46. lifetime of exposure: Total amount of exposure to a substance that a human would receive in a lifetime (usually assumed to be seventy years).

47. local and regional access road: That portion of the access route between the 400 series highway and the facility.

48. Margin-of-Safety (MOS): Maximum amount of exposure producing no measurable effect in animals (or studied humans) divided by the actual amount of human exposure in a population.

49. mathematical model: Model used during risk assessment to perform extrapolations.

50. mitigation: Mitigation refers to methods that may be used to prevent, avoid or reduce the severity of risks, impacts or engineering cost concerns. Examples of mitigative measures are flood control measures, and noise control.

51. No-Observed Adverse Effect Level (NOAEL): Dose level at which no adverse response is observed.

52. objectives: Objectives represent a refinement and elaboration of goals. In the case of the goal of minimizing environmental impacts, for example, the objectives specify different elements of the environment to be protracted.

53. partial solidification: Partial solidification is an operating mode in which excess treated effluent from the physical/chemical treatment plant is discharged off-site rather than being solidified and disposed of along with other residues in the engineered landfill.

54. public consultation: The public consultation program consisted of a series of meetings and workshops where individuals and groups, who are directly or indirectly impacted by the siting of an OWMC facility, were able to review and submit their comments on the various stages of the site selection decision-making process.

55. 170 m and 250 m rail access impact zones: Rail access impact zones are 170-metre and 250-metre zones abutting each side of potential rail spur lines.

56. ranking of indicators: Ranking of indicators refers to the assignment of a numeric value to an indicator to establish the relative importance of that indicator within a particular factor.

57. ranking of siting options: Ranking of siting options is the final step in the evaluation process. In this step the relative suitability of the siting options is determined.

58. rare species: Are those plants and animals which have a limited population and distribution in an area.

59. risk: Probability of injury, disease, or death under specific circumstances.

60. risk pathway: A risk pathway is a route of exposure of contaminants to humans. Examples are air (inhalation of contaminants), surface water (ingestion, skin absorption) and ground water (ingestion).

61. scaling: The conversion of data to units of desirability, such as high, medium or low.

62. screening of factors and indicators: Screening of factors and indicators refers to a step in the evaluation process in which factors and indicators were dropped from the analysis where there were no risks, impacts or costs for all siting options, where there were no differences among options or where it was not possible to put the indicator into effect.

63. sensitivity analyses: Sensitivity analyses are evaluation methods to determine the effect of different facility assumptions (e.g. rail versus road access, total versus partial solidification) on the ranking of the siting options.

64. SEU: SEU is a short form for Sensitive Environmental Units. SEUs include Environmentally Significant Areas, Areas of Natural and Scientific Interest, and Areas of Important Biological Resources, all of which have been designated in published reports.

65. site: Site refers to the eight candidate sites identified at the end of Phase 3B (i.e. LF-9C, LF-3C, LF-1E, PI-27E, PI-1N, PI-13N, LF-4N, LF-2N).

66. site acquisition area: The area identified in Phase 3B and further refined in Phase 4A, required for the location of facilities, including any buffer zones.

67. site vicinity: Site vicinity refers to the study area used around each of the candidate sites. This area extends approximately 2 km. from the centre of each candidate site.

68. siting option: Siting option refers to the combination of sites required to accommodate all OWMC facilities. An integrated siting option involves all facilities located on one site. For a partially integrated option, two sites are required to accommodate the facilities (i.e. landfill (one site), incinerator (alternate site) and physical/chemical treatment plant (paired with either the landfill or incinerator). The options under consideration at the beginning of Phase 4A were LF-9C, LF-3C, LF-4N/PI-1N, LF-4N/PI-13N, LF-2N/PI-1N, LF-2N/PI-13N, LF-1E, and LF-1E/PI-27E.

69. special waste: Industrial wastes that cannot be adequately dealt with by the existing public facilities, such as municipal sewage treatment plants, municipal incinerators and municipal landfills. Radioactive wastes and municipal wastes are excluded from this definition.

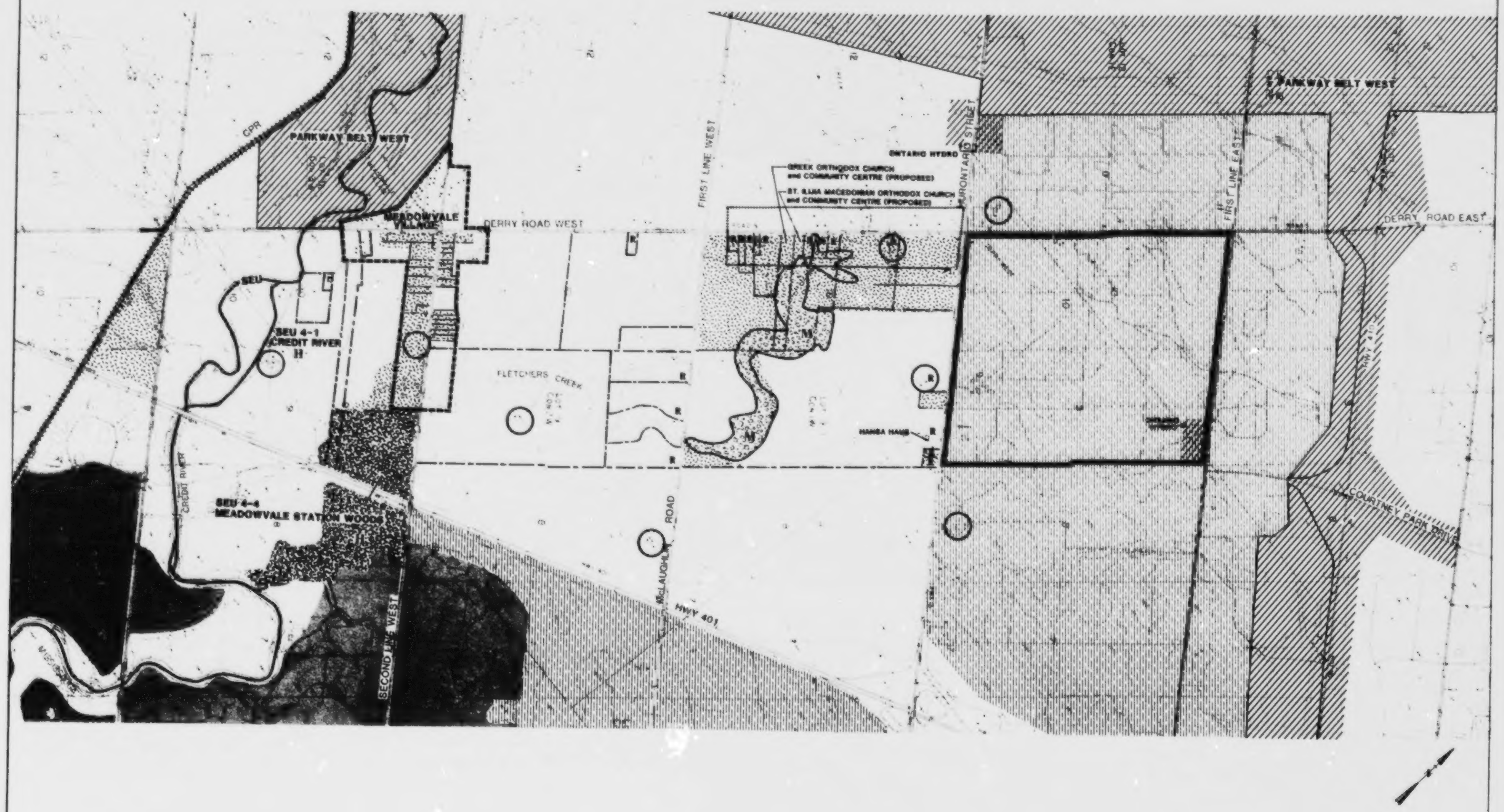
70. study areas: Various study areas were chosen for use by all consultants during the evaluation process. Study areas considered included the site, site vicinity, rail and road access, air dispersion zones and the community and regional study areas.

71. subindicators: Indicators can be divided into subindicators. Subindicators usually represent ways of measuring or providing a finer breakdown of indicators. For example, under the community and regional economic base factor, "area municipality" and "regional municipality" are subindicators for the indicator "number of additional households created".

72. total solidification: Total solidification refers to an operating mode in which excess treated effluent from the physical/chemical treatment plant is solidified and disposed of, along with other residues, in the engineered landfill. The Phase 4A site selection process assumed a total solidification treatment process.

73. toxic: Harmful in regard to the effects of chemicals.

74. tradeoffs: A tradeoff represents a matching of the differences between pairs of siting options. An example of a tradeoff between LF-9C in West Lincoln and LF-4N/PI-1N in Milton is the importance of transportation risk favouring LF-4N/PI-1N against hydrogeologic suitability and air quality favouring LF-9C.


CPR
PARKWAY BELT WEST
MEADOWVALE VILLAGE
DERRY ROAD WEST
SEU
SEU 4-1 CREDIT RIVER
FLETCHERS CREEK
CREDIT RIVER
SEU 4-4 MEADOWVALE STATION WOODS
SECOND LINE WEST
McLAUGHLIN ROAD
HWY 401
FIRST LINE WEST
ONTARIO HYDRO
GREEK ORTHODOX CHURCH and COMMUNITY CENTRE (PROPOSED)
ST. ILIJA MACEDONIAN ORTHODOX CHURCH and COMMUNITY CENTRE (PROPOSED)
HANSA HAUS
HURONTARIO STREET
FIRST LINE EAST
PARKWAY BELT WEST
DERRY ROAD EAST
HWY 410
COURTNEY PARK DRIVE

Contour Interval in Metres

1:10 000 base mapping produced by Surveys and Mapping Branch, Ministry of Natural Resources between [illegible] and [illegible]

OWMC Ontario Waste Management Corporation

Consultant:

DILLON

Legend:

▩ SEU

▨ Non SEU Woodlot greater than 20 hectares in size

▪ Existing Residence

○ Existing Farm Complex

▨ Land Not Cropped

▨ Publicly Owned Land

☐ Cluster Residential (15 + residences)

☐ Village

---- Property Line

Official Plan Designations

▩ Residential

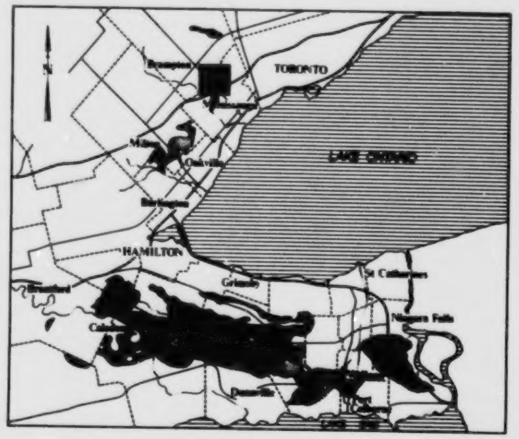
▨ Industrial

•••••••• Existing Rail Line

—— Phase 3B Acquisition Boundary

Key Map: **LF-2 North**

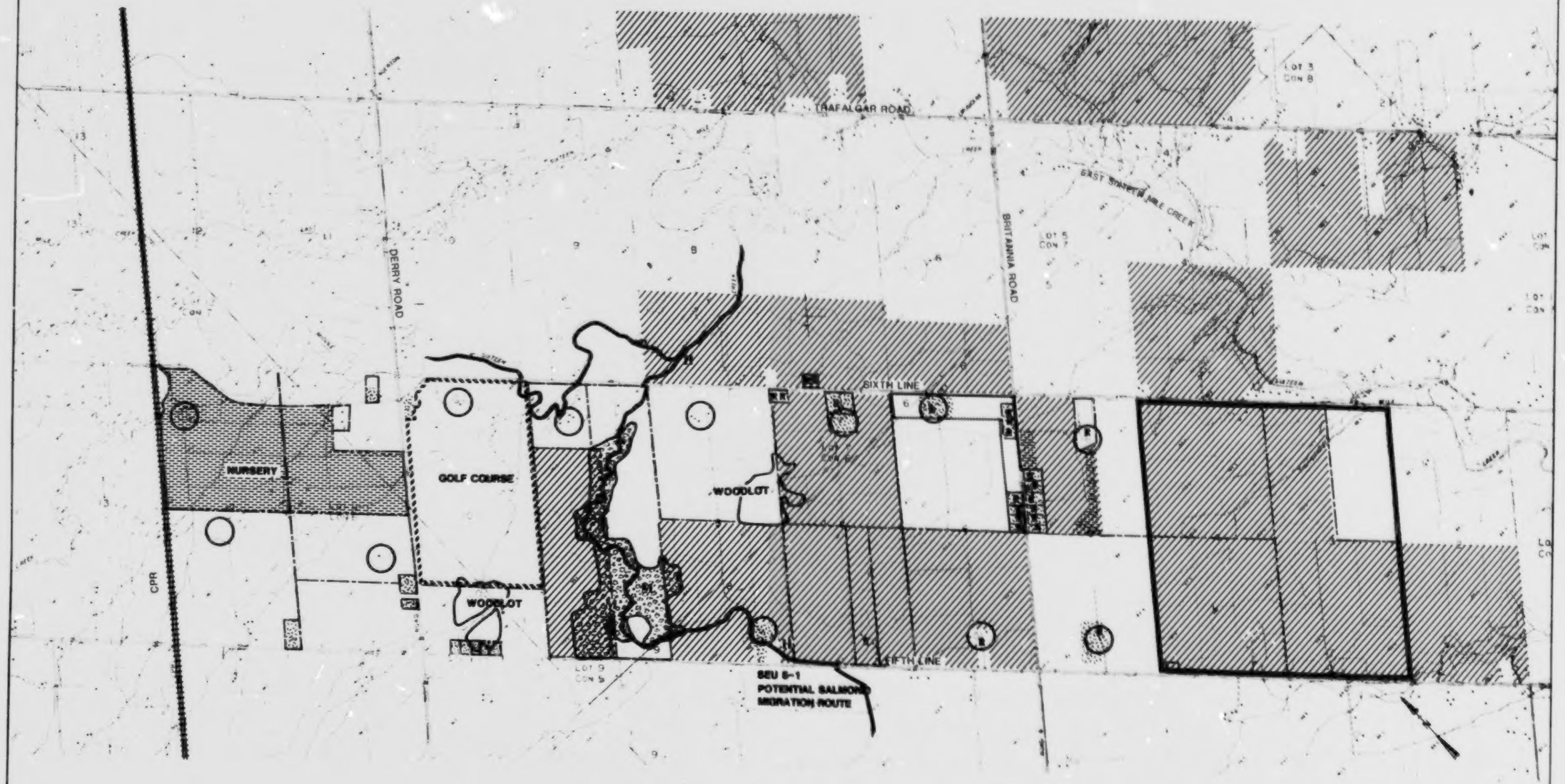
Lots 9 and 10; Concession I EHS (East of Hurontario Street), City of Mississauga


N
Brampton
TORONTO
Mississauga
Milton
Oakville
LAKE ONTARIO
Burlington
HAMILTON
St Catharines
Brantford
Grimsby
Niagara Falls
Caledonia
Dunnville
LAKE ERIE

1000 feet 0 1000
500 metres 0 500

Constraint Mapping Rail Access

July 1986 **Figure 3**



CPR
DERRY ROAD
TRAFALGAR ROAD
BRITANNIA ROAD
EAST SIXTEEN MILE CREEK
LOT 3 CON 8
LOT 5 CON 7
SIXTH LINE
FIFTH LINE
NURSERY
GOLF COURSE
WOODLOT
WOODLOT
LOT 9 CON 5
SEU S-1
POTENTIAL SALMONID MIGRATION ROUTE

Contour Interval in Metres

1:10 000 base mapping produced by Surveys and Mapping Branch, Ministry of Natural Resources between [illegible] and [illegible]

OWMC Ontario Waste Management Corporation

Consultant:

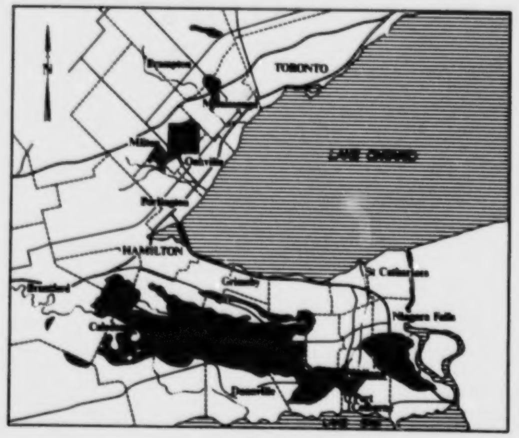
DILLON

Legend:

▨	Non SEU Woodlot greater than 20 hectares in size
L	Low — Constraint Rating
M	Medium — Constraint Rating
H	High — Constraint Rating
⌒	Channel
R	Existing Residence
☐	Cluster Residential (15 + residences)
○	Existing Farm Complex
▨	Specialty Crops
▨	Land Not Cropped
▨	Publicly Owned Land
┅	Community and Recreational Features
—·—·—	Property Line
•••••••	Existing Rail Line
━━	Phase 3B Acquisition Boundary

Key Map: **PI-13 North**

Lots 3 and 4; Concession VI; Town of Milton, formerly the Township of Trafalgar



N
Brampton
TORONTO
Milton
Oakville
LAKE ONTARIO
Burlington
HAMILTON
St Catharines
Niagara Falls
Brantford
Grimsby
Caledonia
Dunnville

1000 feet 0 1000
500 metres 0 500

Constraint Mapping Rail Access

July 1986

Figure 4

Final report

OWMC
**Ontario
Waste Management
Corporation**

A provincial crown corporation.

DILLON

SITE SELECTION PROCESS
PHASE 4A: SELECTION OF A PREFERRED SITE(S)
SITE SELECTION
VOLUME 1 - TECHNICAL APPENDICES

June, 1986

APPENDIX A

(APPENDIX TO CHAPTER 2)

APPENDIX A

INTRODUCTION

Appendix A consists of the following tables:

- Table A.1 - Factors Used in Phase 4A;
- Table A.2 - Summary of Facilities Characteristics Assumptions Employed in Phase 4A Site Selection.

Table A.1 indicates the factors employed for each of the four steps in the Refinement of Siting Options and in the Comparison of Siting Options.

Table A.2 provides the facilities characteristics assumptions employed in Phase 4A, their role in site selection and the source of the assumptions.

TABLE A.1

Factors Used in Phase 4A [1]

FACTOR AND STUDY AREA	REFINEMENT OF SITING OPTIONS				COMPARISON OF SITING OPTIONS
	SITE BOUNDARY REFINEMENT	COMPARATIVE EVALUATION OF ACCESS ROUTE OPTION (PHASE 4A)	COMPARATIVE EVALUATION OF RAIL ACCESS OPTIONS	LOCATION OF PHYSICAL/ CHEMICAL TREATMENT PLANT	
A. **RISK**					
Transportation					
° Annual province-wide hazard-based spill index of OWMC generated transport					X
° Annual province-wide accident involvements of OWMC generated transport					X
° Transportation risks on local and regional access roads due to accident involvements of OWMC generated transport		X		X	X
° Transportation risks on local and regional access roads due to hazard based spills of OWMC generated transport				X	X
° Navigational constraints (4000 m from Airpark)	X				
° Number and type of roads crossed (local, regional, provincial highways)			X		
° Intersection/rail crossing separation distance (m)			X		

---

[1] Factors used after screening by the consultants and Dillon-Site Selection.

TABLE A.1

Factors Used in Phase 4A

FACTOR AND STUDY AREA	REFINEMENT OF SITING OPTIONS				COMPARISON OF SITING OPTIONS
	SITE BOUNDARY REFINEMENT	COMPARATIVE EVALUATION OF ACCESS ROUTE OPTION (PHASE 4A)	COMPARATIVE EVALUATION OF RAIL ACCESS OPTIONS	LOCATION OF PHYSICAL/ CHEMICAL TREATMENT PLANT	
° Cost of rail infrastructure from mainline to plant			X		
° Off-site land acquisition required (rail options)			X		
Air Quality					
° Risk from direct inhalation of emissions - chronic (air dispersion zones)				X (fugitive emissions only)	X
° Risk from direct inhalation of emissions - acute (air dispersion zones)				X (fugitive emissions only)	X
° Risks from ingestion of cistern and pond water (air dispersion zones)				X (fugitive emissions only)	X
° Risks from consumption of crops and livestock (air dispersion zones)				X (fugitive emissions only)	X

TABLE A.1

Factors Used in Phase 4A

FACTOR AND STUDY AREA	REFINEMENT OF SITING OPTIONS				COMPARISON OF SITING OPTIONS
	SITE BOUNDARY REFINEMENT	COMPARATIVE EVALUATION OF ACCESS ROUTE OPTION (PHASE 4A)	COMPARATIVE EVALUATION OF RAIL ACCESS OPTIONS	LOCATION OF PHYSICAL/ CHEMICAL TREATMENT PLANT	
Hydrogeologic Suitability					
° Distance through hydrogeologically sensitive lands:					
- rail access			X		
° Confining layer thickness (site)	X				
° Capability of providing natural containment (site)					X
° Impact on ground water use (site vicinity)					X
Surface Water Suitability					
° Flood susceptibility (site)	X				X
° Downstream water use (downstream to ultimate receiving water body)					X
° Downstream water resources (downstream to ultimate receiving water body)	X				
° Transportation risk to surface water (access roads)		X			

TABLE A.1

Factors Used in Phase 4A

FACTOR AND STUDY AREA	REFINEMENT OF SITING OPTIONS				COMPARISON OF SITING OPTIONS
	SITE BOUNDARY REFINEMENT	COMPARATIVE EVALUATION OF ACCESS ROUTE OPTION (PHASE 4A)	COMPARATIVE EVALUATION OF RAIL ACCESS OPTIONS	LOCATION OF PHYSICAL/ CHEMICAL TREATMENT PLANT	
Surface Water Suitability (Cont'd)					
° Number of stream crossings (rail access routes)			X		
° Number of floodplains and flood prone areas and wetlands (rail access routes)			X		
B. IMPACTS					
Residents					
° Displacement (site)	X		X		X
° Disruption of day-to-day activities and/or the use and enjoyment of property:					
- adjacent	X				X
- site vicinity (adjacent and non-adjacent)				X	X
- access roads		X		X	X
- rail access			X		

TABLE A.1

Factors Used in Phase 4A

FACTOR AND STUDY AREA	REFINEMENT OF SITING OPTIONS				COMPARISON OF SITING OPTIONS
	SITE BOUNDARY REFINEMENT	COMPARATIVE EVALUATION OF ACCESS ROUTE OPTION (PHASE 4A)	COMPARATIVE EVALUATION OF RAIL ACCESS OPTIONS	LOCATION OF PHYSICAL/ CHEMICAL TREATMENT PLANT	
Community and Recreation Features					
° Displacement (site)	X		X		
° Disruption of operations of community and recreation features:					
- adjacent to site	X				X
- site vicinity					X
- access roads		X		X	X
- rail access			X		
° Displacement of archaeological resources (site)	X				X
Community and Region					
° Social stability					X
° Social cohesion					X
° Community character					X

TABLE A.1

Factors Used in Phase 4A

FACTOR AND STUDY AREA	REFINEMENT OF SITING OPTIONS				COMPARISON OF SITING OPTIONS
	SITE BOUNDARY REFINEMENT	COMPARATIVE EVALUATION OF ACCESS ROUTE OPTION (PHASE 4A)	COMPARATIVE EVALUATION OF RAIL ACCESS OPTIONS	LOCATION OF PHYSICAL/ CHEMICAL TREATMENT PLANT	
Land Use					
° Existing land use:					
- site					X
- site vicinity	X				X
- community and region					X
- access roads					X
° Proposed and planned land use:					
- site				X	X
- site vicinity	X			X	X
- community and region					X
- access roads		X			X
° Land use stability:					
- site					X

TABLE A.1

Factors Used in Phase 4A

FACTOR AND STUDY AREA	REFINEMENT OF SITING OPTIONS				COMPARISON OF SITING OPTIONS
	SITE BOUNDARY REFINEMENT	COMPARATIVE EVALUATION OF ACCESS ROUTE OPTION (PHASE 4A)	COMPARATIVE EVALUATION OF RAIL ACCESS OPTIONS	LOCATION OF PHYSICAL/ CHEMICAL TREATMENT PLANT	
Land Use (Cont'd)					
- site vicinity					X
° Provincial policies and plans (site vicinity and community and region)					X
° Number and type of commercial facilities	X		X		
Economic Impacts					
° Displacement of businesses (site)					X
° Change in property values (site vicinity)					X
° Municipal finance (community and region)					X
° Regional and community economic base					X
° Business activities positively affected by presence of OWMC facilities (site vicinity)					X
° Business activities negatively affected by presence of OWMC facilities (site vicinity)					X
° Tourism economy (community and region)					X

TABLE A.1

Factors Used in Phase 4A

FACTOR AND STUDY AREA	REFINEMENT OF SITING OPTIONS				COMPARISON OF SITING OPTIONS
	SITE BOUNDARY REFINEMENT	COMPARATIVE EVALUATION OF ACCESS ROUTE OPTION (PHASE 4A)	COMPARATIVE EVALUATION OF RAIL ACCESS OPTIONS	LOCATION OF PHYSICAL/ CHEMICAL TREATMENT PLANT	
Economic Impacts (Cont'd)					
° Tourism operations (site vicinity)					X
Agricultural Resources					
° Displacement of farms with on-site headquarters (site)	X				X
Agricultural Resources					
° Loss of farmland:					X
- site	X				
- rail access options			X		
° Partial displacement of farms (site vicinity)					X
° Disruption of farm operations:					
- adjacent to site				X	X
- non-adjacent to site (site vicinity)					X

TABLE A.1

Factors Used in Phase 4A

FACTOR AND STUDY AREA	REFINEMENT OF SITING OPTIONS				COMPARISON OF SITING OPTIONS
	SITE BOUNDARY REFINEMENT	COMPARATIVE EVALUATION OF ACCESS ROUTE OPTION (PHASE 4A)	COMPARATIVE EVALUATION OF RAIL ACCESS OPTIONS	LOCATION OF PHYSICAL/ CHEMICAL TREATMENT PLANT	
Agricultural Resources (Cont'd)					
° Stability of farm population (community and regional)					X
° Stability of agricultural land base (community and regional)				X	X
° Disruption to farm economy (community and regional)					X
° Proximity to farm buildings			X		
° Severance of farm parcels			X		
° Farm businesses along access roads		X			
° Disruption to farm traffic and cattle crossings (access roads)				X	X
° Disruption to crop and livestock production (adjacent to access roads)					X
° Cropland:					
- site	X				

TABLE A.1

Factors Used in Phase 4A

FACTOR AND STUDY AREA	REFINEMENT OF SITING OPTIONS				COMPARISON OF SITING OPTIONS
	SITE BOUNDARY REFINEMENT	COMPARATIVE EVALUATION OF ACCESS ROUTE OPTION (PHASE 4A)	COMPARATIVE EVALUATION OF RAIL ACCESS OPTIONS	LOCATION OF PHYSICAL/ CHEMICAL TREATMENT PLANT	
Agricultural Resources (Cont'd)					
- rail access options			X		
Natural Environment					
° Rare species:	X				X
- site					X
- site vicinity			X		
- rail access options					
° Natural vegetation displaced (site)	X				X
° Potential for occurrence of additional significant features (site)					X
° SEUs:					
- site vicinity					X
- rail access options			X		
° Other natural vegetation (site vicinity)					X

TABLE A.1

Factors Used in Phase 4A

FACTOR AND STUDY AREA	REFINEMENT OF SITING OPTIONS				COMPARISON OF SITING OPTIONS
	SITE BOUNDARY REFINEMENT	COMPARATIVE EVALUATION OF ACCESS ROUTE OPTION (PHASE 4A)	COMPARATIVE EVALUATION OF RAIL ACCESS OPTIONS	LOCATION OF PHYSICAL/ CHEMICAL TREATMENT PLANT	
Natural Environment (Cont'd)					
° Displacement of natural features (site)				X	
° Fish and wildlife features of significance:					
- site vicinity					X
- rail access options			X		
° Fish communities (access roads)		X		X	X
° Fish and wildlife communities (site)	X				
° Non-SEU woodlots > 20 ha in size:					
- rail access options			X		
Air Quality					
° Restraints to dispersion (air dispersion zones)				X	X
° Existing and anticipated air quality (air dispersion zones)				X	X

TABLE A.1

Factors Used in Phase 4A

FACTOR AND STUDY AREA	REFINEMENT OF SITING OPTIONS				COMPARISON OF SITING OPTIONS
	SITE BOUNDARY REFINEMENT	COMPARATIVE EVALUATION OF ACCESS ROUTE OPTION (PHASE 4A)	COMPARATIVE EVALUATION OF RAIL ACCESS OPTIONS	LOCATION OF PHYSICAL/ CHEMICAL TREATMENT PLANT	
C. **ENGINEERING**					
° Capital Cost			X	X	X
° Operating Cost				X	X
° Road Improvement Cost		X			
° Site Area	X		X	X	X
° Flexibility					X

TABLE A.2

Summary of Facilities Characteristics Assumptions Employed in Phase 4A Site Selection[1]

PARAMETER	ASSUMPTION	ROLE IN SITE SELECTION AND COMMENTS	SOURCE
A. General	The initial OWMC treatment facility will be sized for treating 150,000 t/a of incoming waste and will treat 300,000 t/a by the year 2001.	o affects estimates of wastes to be transported o site selection employed the 300,000 t/a scenario as a worst case scenario o affects site size requirements established in Phase 3B	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering
	The opening date for the OWMC facility is assumed to be 1991.	o implications for transportation analysis	o OWMC
	The facility will be designed to handle the special waste requiring treatment as defined in Phase 4A. Selection of a Preferred Site(s) - Engineering (1985).	o implications for waste quantities employed in transportation analyses o affects facility design and layout	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering
	Solidified residues from the treatment process receive the most secure containment possible.	o affects hydrogeologic suitability o affects landfill life analysis and mitigation	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering
	The site selection process has assumed a conventional landfill.	o affects size requirements o affects height of landfill o affects soil depth requirements	o OWMC. 1984a. Facilities Development Process - Phase 3 Report
B. Design			
o landfill	In the landfill, solidified residues from the treatment processes are intentionally and permanently placed on or below the ground surface. The landfill will accept only treated residues which will be primarily inorganic in nature.	o affects hydrogeologic analysis and conclusions	o Gartner Lee Associates o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering.

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[1] Changes or additions to facilities characteristics assumptions as a result of the adoption of partial solidification as a mitigative measure are noted by a "+".

TABLE A.2

Summary of Facilities Characteristics Assumptions Employed in Phase 4A Site Selection[1]

PARAMETER	ASSUMPTION	ROLE IN SITE SELECTION AND COMMENTS	SOURCE
B. Design - Cont'd			
	The conventional landfill will be designed and operated in a way which will minimize the formation of leachate and to minimize its release into the surrounding environment. A detailed monitoring network will be provided and mitigation will be prepared to deal with any problem that may be revealed by the monitoring.	o affects hydrogeologic analysis and conclusions	o Gartner Lee Associates
	No excavated material will be removed from the landfill site, unless for remedial purposes.	o potential effect on noise and visual impacts	o Gartner Lee Associates
o landfill technology	Only treated solidified residue and inert slag will be placed in the landfill.	o affects hydrogeologic analysis and conclusions	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering
o characteristics of buildings	The tallest of the facility buildings will be approximately 26 m in height.	o affects visual impact assessment, land use capability	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering
o lighting	The facilities (except the landfill) will be properly lit at night (although lights will be focused downwards on the site rather than outwards to minimize disruption).	o affects visual impact assessment, land use compatability issue, impact on disruption of adjacent residents	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering
o fencing	Case 1 - Integrated Sites: There will be fence around the operating area, the site boundary and along the access road between the site boundary and the operating area. Case 2 - Landfill Sites: There will be fencing around the total land parcel. PI-Sites: There will only be fencing around the operating area.	o implications for land use, visual, social and biological impacts	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering

TABLE A.2

Summary of Facilities Characteristics Assumptions Employed in Phase 4A Site Selection[1]

PARAMETER	ASSUMPTION				ROLE IN SITE SELECTION AND COMMENTS	SOURCE
B. Design – Cont'd						
	Case 3 - Phys/Chem Landfill Sites: There will be fencing around the operating area, the site boundary and along the access road between the site boundary and the operating area.					
	Case 3 - Incinerator Sites: There will only be fencing around the operating area.					
o security	Security systems will be in place to ensure there is no unauthorized access to the facility and to regulate movements on-site.				o implications for social and risk assessment analyses	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering
C. Waste Quantities and Characteristics						
o waste quantities	Year of Operation	Total	Inorganic	Shifts/ Day – Phys/Chem	o affects estimate of wastes to be transported	o OWMC
	1	50,000	30,000	1	o site selection employed the 300,000 t/a scenario as a worst case	
	2	70,000	50,000	1		
	3	105,000	80,000	2		
	4	130,000	100,000	2	• affects transportation, noise, social, land use and economic impacts	
	5	150,000	120,000	3		
	6	180,000	144,000	3		
	7	210,000	168,000	2[2]	o employed in generic risk assessment	
	8	240,000	192,000	2		
	9	270,000	216,000	3	o affects site size requirements established in Phase 3B	
	10	300,000	240,000	3		
	11	300,000	240,000	3		
	[2] (expanded capacity)					
	At an annual total facility waste stream of 300,000 tonnes, annual volume of landfill wastes would be 384,300 t/a.				o affects hydrogeologic suitability, landfill life requirements	o OWMC

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[1] Changes or additions to facilities characteristics assumptions as a result of the adoption of partial solidification as a mitigative measure are noted by a "+".

TABLE A.2

Summary of Facilities Characteristics Assumptions

Employed in Phase 4A Site Selection[1]

PARAMETER	ASSUMPTION	ROLE IN SITE SELECTION AND COMMENTS	SOURCE
C. Waste Quantities and Characteristics - Cont'd	At an annual total facility waste stream of 300,000 tonnes, annual volume of landfill wastes would be 170,900 t/a.		
o process	Total solidification of residue from physical/chemical treatment of inorganics and thermal destruction of organic wastes.	o affects site size requirements and transportation impacts and analysis o affects landfill life	o OWMC
	Partial solidification (alternative effluent disposal) of residue from physical/chemical treatment of inorganics and thermal destruction of organic wastes.	o affects site size requirements and transportation impacts and analyses o affects landfill life	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering
	Source of cement additives is assumed to be Mississauga. Approximately 52,700 tonnes per annum are required for the 300,000 tonnes per annum scenario. (Approximately 26,350 tonnes per annum are required for the 150,000 tonnes per annum scenario.)	o employed in transportation cost analysis	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering
	Source of cement additives is assumed to be Mississauga. Approximately 17,600 tonnes per annum are required for the 300,000 tonnes per annum scenario. (Approximately 8,800 tonnes per annum are required for the 150,000 tonnes per annum scenario.)+	o employed in transportation cost analysis	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering

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TABLE A.2

Summary of Facilities Characteristics Assumptions Employed in Phase 4A Site Selection[1]

PARAMETER	ASSUMPTION	ROLE IN SITE SELECTION AND COMMENTS	SOURCE
D. Components and Processes			
o facility size	Case 1 - 17.4 ha operating area Case 2 - 17.7 ha central operating area Case 3 - 10.7 ha incineration plant operating area Case 3 - 10.2 ha phys/chem operating area	o affects site size requirements established in Phase 3B o affects facility layout and site access	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering
	LF-9C - 19.9 ha operating area		
o landfill lives	LF-9C - 14 years LF-3C - 19 years LF-1E - 12 years LF-4N/PI-1N - 15.5 years LF-4N/PI-13N - 15.5 years LF-1E/PI-27E - 11 years	o linked to hydrogeologic suitability o affected by solidification technology	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering
	LF-9C - 23.5 years LF-3C - 32.5 years LF-1E - 21 years LF-4N/PI-1N - 24.5 years LF-4N/PI-13N - 24.5 years LF-1E/PI-27E - 19.5	o linked to hydrogeologic suitability o affected by solidification technology	o Phase 3B
o site size	LF-1E - 273 ha (integrated), 135 ha (LF only) PI-27E - 188 ha LF-3C - 206 ha LF-9C - 135 ha LF-4N - 168 ha PI-1N - 175 ha PI-13N - 170 ha LF-2N - 172 ha	o implications for facility layout	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering

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TABLE A.2

Summary of Facilities Characteristics Assumptions Employed in Phase 4A Site Selection[1]

PARAMETER	ASSUMPTION	ROLE IN SITE SELECTION AND COMMENTS	SOURCE
D. Components and Processes - Cont'd			
	These sizes include technical buffer zones of 50 m from the outside perimeter of landfill cells and 400 m from the point of emissions from treatment facilities. The buffer zone for Phase 4A is measured from the physical/chemical treatment plant, the physical/chemical tank farm, the incinerator tank farm, the tank truck unloading bays, the incinerator waste receiving tanks and the drum storage and handling building.	o implications for air dispersion/air quality analysis and generic risk assessment o the technical buffer of 400 m is based upon on meeting Provincial air emissions standards for extremely infrequent accidental emissions and is intended to minimize nuisance effects upon sensitive uses in the vicinity of the site o the technical buffer of 50 m is intended to permit space for remedial action in the event of horizontal migration and leachate, despite all precautions. The landfill is considered a suitable use to be located within the 400 m technical buffer for the incinerator physical/chemical plant	o M.M. Dillon Ltd. 1984a. Site Selection Process. Phase 3B: Selection of Candidate Sites - Facilities Characteristics and Technical Buffer Zones. o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering
o incineration - capacity and activity levels	Treatment will involve the thermal destruction of organic wastes.	o affects hydrogeologic suitability o affects potential emissions and effluents o affects land use capability o affects buffer and study area analysis	o OWMC. 1984a. Facilities Development Process - Phase 3 Report
	There will be a single incineration site.	o affects number of sites under consideration o affects transportation analysis	o OWMC. 1983a. Facilities Development Process - Phase 2 Report
	Incineration ultimate capacity is assumed to be 60,000 tonnes per year (2 units). The normal incinerator operating schedule is 24 hours per day and 7 days per week.	o implications for noise, social and economic impacts	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering

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TABLE A.2

Summary of Facilities Characteristics Assumptions Employed in Phase 4A Site Selection[1]

PARAMETER	ASSUMPTION	ROLE IN SITE SELECTION AND COMMENTS	SOURCE
D. Components and Processes - Cont'd)			
	The general operating characteristics and appearance of an incinerator are comparable to a medium to heavy industrial use, e.g. potential for noise, odours, fugitive emissions.	o affects potential agricultural, land use and social impacts	o Ontario Waste Management Corporation o M.M. Dillon Limited. 1984a. Site Selection Process. Phase 3B: Selection of Candidate Sites - Facilities Characteristics and Technical Buffer Zones
o phys/chem - capacity and activity levels	Treatment will involve the physical/chemical treatment of inorganic wastes.	o affects hydrogeologic suitability o affects potential emissions and effluents o affects land use compatibility	o M.M. Dillon Limited. 1984a. Site Selection Process. Phase 3B: Selection of Candidate Sites - Facilities Characteristics and Technical Buffer Zones
	There will be a single physical/chemical treatment plant.	o affects number of sites under consideration o affects transportation analysis	o OWMC. 1984a. Facilities Development Process - Phase 3 Report
	Phys/chem ultimate capacity is assumed to be 240,000 tonnes/year. The ultimate operating schedule is 24 hours per day, 5 days per week, 250 days per year.	o implications for noise and social impacts	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering
	The general operating characteristics and appearance of the physical/chemical treatment plant are comparable to a medium industrial use, e.g. potential for noise, odours, fugitive emissions.	o affects potential agricultural, land use and social impacts	o Ontario Waste Management Corporation o M.M. Dillon Limited. 1984a. Site Selection Process. Phase 3B: Selection of Candidate Sites - Facilities Characteristics and Technical Buffer Zones
o solidification activity levels	The operating schedule will increase in conjunction with waste deliveries to 24 hours per day, 5 days per week, 250 days per year.	o implications for noise, social and economic impacts	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering

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TABLE A.2

Summary of Facilities Characteristics Assumptions Employed in Phase 4A Site Selection[1]

PARAMETER	ASSUMPTION	ROLE IN SITE SELECTION AND COMMENTS	SOURCE
D. Components and Processes - Cont'd			
o landfill activity levels	The general operating characteristics and appearance of the conventional landfill are comparable to a solid waste landfill.	o many potential effects associated with solid waste landfill (e.g. potential for methane gas, birds, flying papers) not present with landfill for special waste residues	o Ontario Waste Management Corporation o M.M. Dillon Limited. 1984a. Site Selection Process. Phase 3B: Selection of Candidate Sites - Facilities Characteristics and Technical Buffer Zones
	The quantity of solidified material going to landfill will be 391,900 tonnes/annum (384,300 tonnes/annum solidified waste and 7,600 tonnes/annum incinerator slag).	o affects landfill size and landfill life o role in transportation impact assessment	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering
	The quantity of solidified material going to the landfill is 178,500 tonnes/annum (170,900 tonnes/annum solidified waste and 7,600 tonnes/annum slag) for a Case 1 or Case 2.+	o affects landfill size and landfill life o role in transportation impact assessment	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering
o shifts	Case 1 and Case 3 - single shift, increasing to 3 shifts, 5 days per week, 250 days per year. Case 2 - single shift, 5 days per week, 250 days per year.	o implications for noise, social and economic impacts	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering
o evaporator+	An evaporator building 7 m wide x 15 m long x 16 m high with a 45 m high concrete stack (0.5 m diameter and similar to the incinerator stack) will be located on site.+	o implications for visual, social and economic analyses	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering

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TABLE A.2

Summary of Facilities Characteristics Assumptions Employed in Phase 4A Site Selection[1]

PARAMETER	ASSUMPTION	ROLE IN SITE SELECTION AND COMMENTS	SOURCE
D. Components and Processes - Cont'd			
o types of facilities	Facilities that may be located at a waste treatment site include: - phys/chem treatment plant - incineration plant - solidification plant - landfill cells (at adjacent landfill) - phys/chem tank storage - incinerator tank farm - unloading bays and receiving tanks - incinerator waste receiving tanks - maintenance, workshop and stores - truck wash station - firewater pond - clean storm water pond - potentially contaminated water pond - auxiliary boiler and feedwater treatment - internal access roads/rail spur line - stack - drum conveyor - drum storage and handling building - pipe rack - administration offices - car park - gatehouse and weigh scales - emergency power generation - main substation - truck holding area	o implications for visual impacts, social and economic impacts and land use compatibility	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering

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TABLE A.2

Summary of Facilities Characteristics Assumptions Employed in Phase 4A Site Selection[1]

PARAMETER	ASSUMPTION	ROLE IN SITE SELECTION AND COMMENTS	SOURCE
E. Operations			
o landfill	During the disposal operations, waste residues will be placed in individual cells of limited capacity. This will ensure that the working area is of manageable size and that the facility design can be modified to accommodate future technological advances and contingency plans. It will also help to minimize the quantity of contaminated drainage resulting from precipitation falling on the open cells.	o affects hydrogeologic suitability o affects landfill life analysis and mitigation	o Monenco Limited. 1985a. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering
F. Emissions and Effluents			
o incinerator stack height	Minimum case - 60 m. Maximum case - 100 m.	o affects potential for conflict with airports o implications - visual impacts, social and land use compatibility o influences air dispersion analysis and risk assessment	o OWMC
o stack	There will be only one stack with two flues which will be the main source of airborne emissions. Two flues will be required for the ultimate capacity, i.e. 300,000 t/a scenario (60,000 t/a of organics at 300,000 t/a).	o implications - visual impacts, social and land use compatability	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering
		o influences air dispersion analysis and risk assessment	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering
o exit temperature	Base case - 130°C.	o influences air dispersion analysis	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering

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TABLE A.2

Summary of Facilities Characteristics Assumptions

Employed in Phase 4A Site Selection[1]

PARAMETER	ASSUMPTION	ROLE IN SITE SELECTION AND COMMENTS	SOURCE
F. Emissions and Effluents - Cont'd)			
o exit velocity	Base case - 20 m/s.	o influences air dispersion analysis	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering
o incinerator stack outlet diameter	Base case - 1.84 m - equivalent for two flues (one flue - 1.3 m).	o influences air dispersion analysis	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering
o evaporator stack height	Base case - 45 m.+	o influences air dispersion analysis	o OWMC, ORF
o steam flow rate	19.4 t/h (based on 155,300 t/a and 8,000 h/a).+	o influences air dispersion analysis	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering
o evaporator stack exit diameter	0.508 m + (20 in).+	o influences air dispersion analysis	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering
o evaporator stack exit temperature	100°C.+	o influences air dispersion analysis	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering
o evaporator stack exit velocity	approximately 53 m/s.+	o influences air dispersion analysis	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering

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TABLE A.2

Summary of Facilities Characteristics Assumptions Employed in Phase 4A Site Selection[1]

PARAMETER	ASSUMPTION	ROLE IN SITE SELECTION AND COMMENTS	SOURCE
F. Emissions and Effluents - Cont'd			
o noise, odours, dust	The facility is not expected to have impacts on residents with respect to odour and dust beyond the 2 km zone.	o implications - visual impacts, social and land use compatibility o implications for disruption of adjacent and non-adjacent residents	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering
	Impacts due to emissions of gases from the incinerator stack and other on-site sources are being studied within a 20 km zone measured from the stack. Beyond 2 km emission levels are less than at the maximum point of impingement and diminishing.	o employed in air dispersion analysis o implications for risk assessment o implications for visual impacts, social impacts and land use compatibility	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering o Ontario Research Foundation. 1985. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Atmospheric Considerations
	Noise level changes around the site perimeter will be calculated based upon site equipment, noise characteristics and location of noise source generators on-site.	o implications for analysis of social impacts o implications for land use compatibility	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering o M.M. Dillon Limited. 1985b. Site Selection Process. Phase 4A: Selection of a preferred site(s) - Transportation
	Dust will be largely controlled.	o implications for analysis of social impacts o implications for land use compatibility	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering o OWMC
o air emissions	The source of emissions is within the central operating area.	o implications for technical buffer zone	o M.M. Dillon Limited. 1984a. Site Selection Process. Phase 3B: Selection of Candidate Sites - Facilities Characteristics and Technical Buffer Zones

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[1] Changes or additions to facilities characteristics assumptions as a result of the adoption of partial solidification as a mitigative measure are noted by a "+".

TABLE A.2

Summary of Facilities Characteristics Assumptions

Employed in Phase 4A Site Selection[1]

PARAMETER	ASSUMPTION	ROLE IN SITE SELECTION AND COMMENTS	SOURCE
F. Emissions and Effluents - Cont'd			
		o employed in air dispersion analysis	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering
	Incinerator stack and fugitive emissions will adhere at least to provincial standards. Generally emissions are expected to be well below those permitted under MOE regulations.	o considered in formulation of technical buffer	o OWMC
o liquid effluent	All contaminated water and process waste from the facility will be treated. Under the total solidification option there will be no liquid effluent.	o implications for surface water analysis o OWMC	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering
	All contaminated water and process waste from the facility will be treated. Under the partial solidification option, the treated effluent will be disposed of by evaporation. A preliminary analysis of disposal of effluent by evaporation indicates that: - the quality of the effluent being evaporated will meet regulations and guidelines; - fogging or icing effects off-site appear to be unlikely; - the steam plume will be highly visible and may travel beyond the site boundaries.+	o implications for surface water analysis o implications for visual impacts, social impacts and land use compatibility o affects transportation analysis	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering o OWMC o Ontario Research Foundation. 1985. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Atmospheric Considerations

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[1] Changes or additions to facilities characteristics assumptions as a result of the adoption of partial solidification as a mitigative measure are noted by a "+".

TABLE A.2

Summary of Facilities Characteristics Assumptions

Employed in Phase 4A Site Selection[1]

PARAMETER	ASSUMPTION	ROLE IN SITE SELECTION AND COMMENTS	SOURCE
F. Emissions and Effluents - Cont'd			
o surface water drainage	Runoff from the active landfill cell area and the plant site will be collected and tested before discharge. If the water does not meet the discharge quality criteria then it will be treated. Design event return period is 25 years for storm sewers and 100 years for ponds. Other surface runoff will be directed away from these areas and will not be collected.	o implications for surface water analysis	o Monenco Limited. 1985. Status Report. Facility Design.
	Only "non-contaminated" storm water will be discharged to local water courses.	o implications for surface water analysis o implications for aquatic biology	o Monenco Limited. 1985. Status Report. Facility Design.
	"Non-contaminated" storm water is runoff from non-contaminated surfaces in both the operational and non-operational areas of the facility site.	o implications for surface water analysis	o Monenco Limited. 1985. Status Report. Facility Design.
	Non-contaminated surfaces in the operational area are expected to include roof tops, parking lots (administration) and grassed areas that are not used by or drain through areas used by vehicles transporting waste material or subject to contamination from leakage/spillage of waste material. Non-contaminated surfaces in the non-operational area include the buffer zone and the undeveloped portion of the landfill site.	o implications for surface water analysis	o Monenco Limited. 1985. Status Report. Facility Design.
	Storm water from the operating facility will be retained in a retention pond and tested to ensure that it is uncontaminated and then released to local watercourses. If tests indicate that this storm water is contaminated, then it will be treated. Clean runoff from the undeveloped and completed landfill areas will be retained to control peak flows. Continuous monitoring of landfill drainage with provisions for shut-off of outlet may be provided.	o implications for surface water analysis	o Monenco Limited. 1985. Status Report. Facility Design. o Gartner Lee Associates Limited

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[1] Changes or additions to facilities characteristics assumptions as a result of the adoption of partial solidification as a mitigative measure are noted by a "+".

TABLE A.2

Summary of Facilities Characteristics Assumptions Employed in Phase 4A Site Selection[1]

PARAMETER	ASSUMPTION	ROLE IN SITE SELECTION AND COMMENTS	SOURCE
F. Emissions and Effluents - Cont'd			
	Storm water drainage from the operational portion of the landfill site will be drained to temporary retention ponds and the water will be tested to ensure that it is uncontaminated before being released to a local watercourse. If found to be contaminated, the storm water will be treated.	o implications for surface water analysis	o Monenco Limited. 1985. Status Report. Facility Design. o Gartner Lee Associates Limited
o leachate collection	Leachate will be collected from underdrains in the landfill in the initial cells to provide information on leachate generation and leachate quality.	o implications for hydrogeologic suitability	o Monenco Limited. 1985. Status Report. Facility Design.
G. Off-Site Services Requirements			
o utility corridors	Site will require utilities or pipeline access related to some or all of the following: - electrical power; - telephone service; - natural gas; - water supply; and - sanitary sewage.	o implications for facility design and layout	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering
H. Transportation			
o trucking operations	Trucking operations will be limited to regular (7 a.m. to 5 p.m.) daylight hours on a five-day schedule (Monday to Friday) with no regularly scheduled night-time and weekend deliveries.	o implications for social impact and noise analyses o employed in transportation analysis	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering

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[1] Changes or additions to facilities characteristics assumptions as a result of the adoption of partial solidification as a mitigative measure are noted by a "+".

TABLE A.2

Summary of Facilities Characteristics Assumptions Employed in Phase 4A Site Selection[1]

PARAMETER	ASSUMPTION	ROLE IN SITE SELECTION AND COMMENTS	SOURCE
H. Transportation - Cont'd			
o truck traffic	Assume 180 vehicles per day (two way movements) in the movement of all waste, reagents and additives and process by-products.	o employed in transportation analysis	o M.M. Dillon Limited. 1985b. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Transportation
	Assume 79 trucks per day each way or 19,550 trucks per annum in the movement of all waste reagents and additives and process by-products.+	o employed in transportation analysis	o M.M. Dillon Limited. 1985b. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Transportation
	Assume five trucks per day or 1,222 trucks per annum for the trucking of chemicals and reagents to the facility. Assume 27 trucks per day or 6,824 trucks per annum for intersite truck transfers of solidified materials.+	o employed in transportation analysis	o M.M. Dillon Limited. 1985b. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Transportation
	All special waste can be assumed to arrive by road transport only, for purposes of site selection.	o implications for transportation analysis	o OWMC
	Shipment of bulk reagents and/or additives can be assumed to arrive by road or by rail.	o implications for transportation analysis o rail used as a sensitivity analysis in site selection	o OWMC
o waste truck size	The truck sizes assumed for delivery of special wastes to a site are: 18-tonne tanker trucks for pumpable waste, 24-tonne dump or lugger truckers for non-pumpables and 10-tonne flat bed or van body trucks for drummed waste.	o implications for transportation analysis and transportation costs	o M.M. Dillon Limited. 1984a. Site Selection Process. Phase 3B: Selection of Candidate Sites - Facilities Characteristics and Technical Buffer Zones

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[1] Changes or additions to facilities characteristics assumptions as a result of the adoption of partial solidification as a mitigative measure are noted by a "+".

TABLE A.2

Summary of Facilities Characteristics Assumptions Employed in Phase 4A Site Selection[1]

PARAMETER	ASSUMPTION	ROLE IN SITE SELECTION AND COMMENTS	SOURCE
H. Transportation - Cont'd			
o intersite transfer vehicle size	Vehicles to be used for hauling processed waste between non-integrated sites include: 30-tonne semi-trailer dump body for solidifying waste, a 30-tonne semi-trailer tank body for landfill effluent and pretreated organics from physical/chemical plant, and 19 to 37-tonne trucks for additives and reagents depending upon commodities to be handled.	o implications for transportation analysis and transportation costs	o M.M. Dillon Limited. 1985b. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Transportation
o rail transport	Rail service to a candidate site is not viewed as a requirement, but rather as an opportunity.	o implications for transportation analysis o provision of rail service has rail implications for overall impact assessment	o OWMC
o waste containerization	It is assumed that 3% of the waste stream will arrive in drums. This figure is applied to organics and inorganics, both pumpable and non-pumpable.	o implications transportation analysis	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering o M.M. Dillon Limited. 1985b. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Transportation
I. Contingency Planning			
o monitoring	Monitoring for contaminant release will be an integral part of all facilities operations and this monitoring will trigger activation of contingency measures if unacceptable contaminant release is detected. Such contingency planning measures will be aimed at rapid response to remedy the problem such as safe shutdown of the malfunctioning equipment or clean-up in the event of accidental liquid spills or leaks.	o affects hydrogeologic analysis and conclusions o implications for land use, social, agricultural and biological impacts	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering o Gartner Lee Associates Limited o OWMC

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[1] Changes or additions to facilities characteristics assumptions as a result of the adoption of partial solidification as a mitigative measure are noted by a "+".

TABLE A.2

Summary of Facilities Characteristics Assumptions Employed in Phase 4A Site Selection[1]

PARAMETER	ASSUMPTION	ROLE IN SITE SELECTION AND COMMENTS	SOURCE
J. Work Force	During the construction phase, the construction workers will generally commute to the site and therefore it is not expected that there will be a need to provide housing and other services and facilities in the community.	o employed in economic base analysis	o Institute of Environmental Research Inc. (IER). 1985a. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Social Analysis.
		o potential impacts on population levels and characteristics economic base of community, social and economic character of area, and municipal finance and services	o Clayton Research Associates Limited. 1985a. Site Selection Access. Phase 4A: Selection of a Preferred Site(s) - Economic Base
	OWMC will not exercise any control on the residential location of their operations employees.	o employed in economic base analysis	o OWMC
	Employment levels for the 300,000 tonnes per annum scenario are employed in the economic analysis. These levels are as follows (for total solidification): (a) integrated site - 221; (b) partially integrated - separate landfill - 217; (c) partially integrated - separate incinerator - 231.	o employed in economic base analysis	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering
	Employment levels for the 300,000 tonnes per annum scenario are employed in the economic analysis. These levels are as follows (for partial solidification): (a) integrated site - 225; (b) partially integrated - separate landfill - 221; (c) partially integrated - separate incinerator - 235.	o employed in economic base analysis	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering

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[1] Changes or additions to facilities characteristics assumptions as a result of the adoption of partial solidification as a mitigative measure are noted by a "*".

TABLE A.2

Summary of Facilities Characteristics Assumptions Employed in Phase 4A Site Selection[1]

PARAMETER	ASSUMPTION	ROLE IN SITE SELECTION AND COMMENTS	SOURCE
K. Assessment and Costs	OWMC will make payments-in-lieu of taxes to the host municipality.	o employed in municipal finance and services analysis	o OWMC
	The OWMC facilities will not create any capital or operating costs for sewer and water services for the municipality, to the extent that improvement costs are incurred these will be met by OWMC.	o employed in municipal finance and services analysis o implications for social impact analysis	o OWMC
	Estimated construction cost of OWMC buildings that are liable for municipal assessment:	o employed in municipal finance and services analysis	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering
	Estimated construction cost of OWMC buildings that are liable for municipal assessment: Case 1 - physical/chemical plant $10,244,984 - incinerator 12,546,300 - solidification 1,896,492 - landfill - - physical/chemical tank farm 12,313,998 - incinerator tank farm 3,779,820 - tank truck unloading 3,369,390 - incinerator receiving tanks 764,023 - maintenance shops, stores, including garage for emergency vehicles 1,045,731 - truck wash stations 206,666 - auxiliary boiler and feedwater treatment 350,802 - incinerator stack 1,386,800 - drum handling and storage 5,636,658 - administration offices 3,633,540 - car park 157,535 - gatehouse and weigh scales 168,360 - emergency power station 349,845	o employed in municipal finance and services analysis	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering

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[1] Changes or additions to facilities characteristics assumptions as a result of the adoption of partial solidification as a mitigative measure are noted by a "+".

TABLE A.2

Summary of Facilities Characteristics Assumptions Employed in Phase 4A Site Selection[1]

PARAMETER	ASSUMPTION	ROLE IN SITE SELECTION AND COMMENTS	SOURCE
K. Assessment and Costs - Cont'd	- main substation 380,266 - truck holding area 112,525 - evaporator building 115,000+ - evaporator stack 460,000+		
	A conventional configuration is assumed for landfill cells (24.8 ha), perimeter 50 m strip (technical buffer zone) with berming and ditching (24 ha), rail and road buffer (6.4 ha), access roads (5.6 ha) and a sediment pond (4.2 ha). There could be a considerable variation in area depending on the solidification technology and the dimensions of the landfill cells.	o employed in municipal finance and services analysis	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering
L. Zoning	The site areas of the OWMC facilities which will be zoned industrial are as follows:	o employed in municipal finance and services analysis	o Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering
	Case I: Integrated Facility — Hectares - physical/chemical treatment plant, incinerator and associated buildings — 17.4 (19.9 on LF-9C) - landfill — 62.0 total — 79.4 (81.9 on LF-9C)		o Clayton Research Associates Limited. 1985b. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Municipal Finance and Services Analysis
	Case II: Partially Integrated Facility, Landfill Separate — Hectares - physical/chemical treatment plant, incinerator and associated buildings — 17.7 - landfill — 62.0	o employed in municipal finance and services analysis	

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[1] Changes or additions to facilities characteristics assumptions as a result of the adoption of partial solidification as a mitigative measure are noted by a "+".

TABLE A.2

Summary of Facilities Characteristics Assumptions

Employed in Phase 4A Site Selection[1]

PARAMETER	ASSUMPTION		ROLE IN SITE SELECTION AND COMMENTS	SOURCE
L. Zoning - Cont'd	Case III: Partially Integrated Facility, Incinerator Separate	Hectares		
	- physical/chemical treatment plant and associated buildings	10.2		
	- landfill	62.0		
	- total	72.2		
	- incinerator and associated buildings	10.7		
M. Other	OWMC will not undertake any specific role in industrial development of lands adjacent or in the vicinity of the site.		o implications - visual impacts, social and land use compatibility	o OWMC
	OWMC will not undertake any land value protection policy beyond the site and immediate adjacent area.		o implications for analysis of social impacts	o OWMC

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[1] Changes or additions to facilities characteristics assumptions as a result of the adoption of partial solidification as a mitigative measure are noted by a "+".

APPENDIX B

(APPENDIX TO CHAPTER 5)

APPENDIX B

INTRODUCTION

Appendix B consists of the following tables:

Table B.1 - Factors Used in Preliminary Phase 4A Analysis of Access Route Options

Table B.2 - Summary of Consultants' Ranking of Factors - Preliminary Phase 4A Analysis of Access Road Options

Table B.3 - Consultants' Rankings of Options - LF-3C

Table B.4 - Overall Ranking of Access Road Options - LF-3C

Table B.5 - Consultants' Rankings of Options - LF-9C

Table B.6 - Overall Ranking of Access Road Options - LF-9C

Table B.7 - Consultants' Rankings of Options - LF-1E

Table B.8 - Overall Ranking of Access Road Options - LF-1E

Table B.9 - Consultants' Rankings of Options - PI-1N

Table B.10 - Overall Ranking of Access Road Options - PI-1N

Table B.11 - Consultants' Rankings of Options - PI-1N to LF-2N

Table B.12 - Overall Ranking of Access Road Options - PI-1N to LF-2N

Table B.13 - Consultants' Rankings of Options - PI-13N

Table B.14 - Overall Ranking of Access Road Options - PI-13N

Table B.15 - Consultants' Rankings of Options - PI-13N to LF-2N

Table B.16 - Overall Ranking of Access Road Options - PI-13N to LF-2N

Table B.17 - Consultants' Rankings of Options - LF-4N

Table B.18 - Overall Ranking of Access Road Options - LF-4N

Table B.19 - Consultants' Rankings of Access Road Options - PI-27E to LF-1E

Table B.20 - Overall Ranking of Access Road Options - PI-27E to LF-1E

Table B.21 - Factors Used in Phase 4A Analysis of Access Route Options

Table B.22 - Summary of Consultants' Ranking of Factors - Phase 4A Analysis of Access Road Options

Table B.23 - Access Roads - LF-3C - Consultants' Ranking of Options

Table B.24 - Overall Ranking of Access Road Options - LF-3C

Table B.25 - Access Roads - LF-1E - Consultants' Ranking of Options

Table B.26 - Overall Ranking of Access Road Options - LF-1E

Table B.27 - Access Roads - PI-1N to LF-4N - Consultants' Ranking of Options

Table B.28 - Access Roads - PI-27E - Consultants' Ranking of Options

Table B.1 lists the factors used in the preliminary Phase 4A analysis of access route options and a rationale for the factors.

Table B.2 provides a summary of the consultants' ranking of factors employed in the preliminary Phase 4A analysis and a rationale for the ranking.

Tables B.3, B.5, B.7, B.9, B.11, B.13, B.15, B.17 and B.19 provide the consultants' rankings of access road options for those options examined in the preliminary Phase 4A analysis. Tables B.4, B.6, B.8, B.10, B.12, B.14, B.16, B.18 and B.20 list the total factor scores and overall option ranks for the preliminary Phase 4A access roads.

Table B.21 lists the factors used in the Phase 4A analysis of access road options and a rationale for these factors.

Table B.22 provides a summary of the consultants' ranking of factors used in the Phase 4A access road analysis and a rationale for the ranking.

Tables B.23, B.25, B.27 and B.28 list the consultants' rankings of access road options for LF-3C, LF-1E, PI-1N to LF-4N and PI-27E. Tables B.24 and B.26 list the total factor scores and overall option ranks for the Phase 4A access road options.

TABLE B.1

Factors Used in Preliminary Phase 4A
Analysis of Access Route Options

FACTORS	RATIONALE FOR FACTORS
ACCESS ROADS - LOCAL	
1. **Human Environment**	
1.1 **Transportation Safety**	
o **proximity to arterial road**	o where site flanks an arterial road it is probable that direct access can be provided to the site assuming that road geometrics do not preclude the acceptability of the site entrance
	o in instances where the site boundaries are remote from an arterial roadway, provision must be made for improvements of other existing collector or local service roads or the construction of a new roadway from the arterial system to the site boundary
o **number of level railway crossings on local roads and on total**	o level railway crossings on access roads present a potential transportation safety hazard
	o effect of hazard can be minimized by providing railway crossing safety devices
1.2 **Existing Residents**	
o **number and size of population concentrations**	o provides an indication of the number of residents potentially affected should a given route be selected for access to a site
o **number of residences**	o indication of number of residences potentially affected should a given route be selected for access to a site

TABLE B.1

Factors Used in Preliminary Phase 4A Analysis of Access Route Options

FACTORS	RATIONALE FOR FACTORS
ACCESS ROADS - LOCAL	
1.2 Existing Residents - Cont'd	
o estimated population	o an estimate of the population adjacent to an access road option o those routes with fewer adjacent residents preferred
1.3 Existing Agricultural Resources	
o number of active farm complexes	o indicates degree of potential conflict with farming activities and farm families living along the roads o roads with the fewest number of active farm complexes preferred
o number of farm complexes with livestock	o indicates livestock along access road that are at high risk due to accidental spills of untreated waste
o length of access route	o a general indicator of the potential for conflict with farm machinery/ equipment moving along the roads o short roads preferred
1.4 Existing Community and Recreation Features	
o number and type of community and recreation features	o provides an indication of the number of features potentially affected o type of feature provides additional information in the determination of potential impact

TABLE B.1

Factors Used in Preliminary Phase 4A Analysis of Access Route Options

FACTORS	RATIONALE FOR FACTORS
ACCESS ROADS - LOCAL	
1.5 **Future Resources**	
o **length across Class 1 equivalent agricultural land (km)**	o indicates the degree to which land resources may be lost if local roads are widened
2. **Physical and Biological Environment**	
2.1 **Hydrogeology**	
o **distance through hydrogeologically sensitive lands**	o in event of an accidental spill of waste, desirable that natural materials retard migration of contaminants o lands underlain by fine-textured soils provide a relatively high degree of natural containment o lands not likely to provide a high degree of natural containment are defined as sensitive
2.2 **Stream Crossings**	
o **number of stream crossings and constraint rating**	o watercourses could provide pathway for rapid movement of contaminants in the event of a spill o dependent upon characteristics of water course

TABLE B.1

Factors Used in Preliminary Phase 4A
Analysis of Access Route Options

FACTORS	RATIONALE FOR FACTORS
ACCESS ROADS - REGIONAL	
1. Human Environment	
1.1 Transportation Safety	
o composite accident rate (accidents per million vehicles)	o estimated annual all vehicle accident rate is representative of the possibility of a spill along local and regional access routes
o proximity to 400 series highway	o impact of transportation to and from OWMC facility would generally be minimized where sites are close to freeway systems and arterial road interchanges with the 400 series highway
o total number of level railway crossings	o level railway crossings on access roads present a potential transportation safety hazard o affect of hazard can be minimized by providing railway crossing safety devices
o number of intersections where a turn is required	o turns at public intersections pose a possible additional transport risk along access route o present intersection geometrics may not be adequate for heavy trucks which may result in encroachment on opposing traffic

TABLE B.1

Factors Used in Preliminary Phase 4A
Analysis of Access Route Options

FACTORS	RATIONALE FOR FACTORS
ACCESS ROADS - REGIONAL	
1.2 Existing Residents	
o distance through strip residential development (km)	o access route passing through areas with little or no residential strip development are more desirable than through areas of intense or continuous strip development
o number and size of population concentrations	o provides an indication of the number of residents potentially affected should a given route be selected for access to a site
o estimated population	o an estimate of the population adjacent to an access road option
	o those routes with fewer adjacent residents preferred
1.3 Existing Agricultural Resources	
o number of active farm complexes	o indicates degree of potential conflict with farming activities and farm families living along the roads
	o roads with the fewest number of active farm complexes preferred
o number of farm complexes with livestock	o indicates livestock along access roads that are of high risk due to accidental spills of untreated waste
o sensitive crops ($000s)	o measures relative risk to sensitive crops in the event of a spill of untreated waste

TABLE B.1

Factors Used in Preliminary Phase 4A Analysis of Access Route Options

FACTORS	RATIONALE FOR FACTORS
ACCESS ROADS - REGIONAL	
1.3 Existing Agricultural Resources - Cont'd	
o length of access route	o general indicator of the potential for conflict with farm machinery/ equipment moving along the roads o short roads preferred
1.4 Existing Community and Recreation Features	
o number and type of community and recreation features	o provides an indication of the number of features potentially affected o type of feature provides additional information in the determination of potential impacts
2. Physical and Biological Environment	
2.1 Hydrogeology	
o distance through hydrogeologically sensitive lands (m)	o in event of an accidental spill of waste, desirable that natural materials retard migration of contaminants o lands underlain by fine-textured soils provide a relatively high degree of natural containment o lands not likely to provide a high degree of natural containment are defined as sensitive

TABLE B.1

Factors Used in Preliminary Phase 4A
Analysis of Access Route Options

FACTORS	RATIONALE FOR FACTORS
ACCESS ROADS - REGIONAL	
2.2 Stream Crossings	
o number of stream crossings and constraint rating	o watercourses could provide pathhway for rapid movement of contaminants in the event of a spill o dependent upon characteristics of watercourse

TABLE B.2

Summary of Consultants' Ranking of Factors
Preliminary Phase 4A Analysis of Access Road Options

CONSULTANT	AREA OF RESPONSIBILITY	FACTORS	RANKING OF FACTORS	RATIONALE FOR RANKING
Institute of Environmental Research	Social Analysis	o estimated population o number and size of population concentrations o number and type of community and recreation features	most important ↕ less important	o when ranking of options similar, population-related factors given preference in ranking o assumed that potential for disruption was greater for residents than for community and recreation features or their users
Leon Kentridge Associates Ltd.	Land Use	o number of residences o distance through strip residential development	ranked equal	o number of residences used on local road component o distance through strip residential development used on regional road component
M.M. Dillon Ltd.	Transportation	o proximity to arterial road o number of level railway crossings on local roads and on total route o composite accident rate	ranked equal	o all factors considered of equal importance in terms of transportation safety

TABLE B.2

Summary of Consultants' Ranking of Factors

Preliminary Phase 4A Analysis of Access Road Options

CONSULTANT	AREA OF RESPONSIBILITY	FACTORS	RANKING OF FACTORS	RATIONALE FOR RANKING
M.M. Dillon Ltd. (cont'd)		o proximity to 400 series highway		
		o number of intersections where a turn is required		
Ecologistics Ltd.	Agricultural Resources	o length of access route (local roads)	3	o users of local access roads not accustomed to high traffic volumes o potentially high conflict with agricultural activities
		o number of active farm complexes	3	o provides a direct measure of the number of potentially impacted farm operators
		o number of farm complexes with livestock	3	o provides an indirect measure of livestock and poultry at risk due to accidental spills
		o sensitive crops (regional roads)	3	o indicates relative risk to crops
		o length across Class 1 equivalent agricultural land	1	o only a small amount of land required for road widening
		o length of access route (regional roads)	1	o degree of conflict with farming activities lower on regional roads because there are already higher traffic volumes

TABLE B.3

Consultants' Rankings of Options

LF-3C[1]

FACTORS	OPTION 1	OPTION 2	OPTION 3	OPTION 4	OPTION 5	OPTION 6
EXISTING COMMUNITY & RECREATION FEATURES	2	4	1	2	3	2
EXISTING RESIDENTS	5	4	1	2	3	5
TRANSPORTATION SAFETY	5	4	2	3	1	6
EXISTING AGRICULTURAL RESOURCES	1	2	6	3	5	4
STREAM CROSSINGS	1	5	5	5	1	1
HYDROGEOLOGY	2	6	4	5	1	3

[1] Options ranked from most to least preferred (i.e. a 1 is the least preferred option).

TABLE B.4

Overall Ranking of Access Road Options

LF-3C

FACTORS	FACTOR RANK	OPTION 1	OPTION 2	OPTION 3	OPTION 4	OPTION 5	OPTION 6
EXISTING AGRICULTURAL RESOURCES	3	3	6	18	9	15	12
EXISTING RESIDENTS	3	15	12	3	6	9	15
TRANSPORTATION SAFETY	3	15	12	6	9	3	18
EXISTING COMMUNITY & RECREATION FEATURES	2	4	8	2	4	6	4
STREAM CROSSINGS	2	2	10	10	10	2	2
HYDROGEOLOGY	1	2	6	4	5	1	3
TOTAL FACTOR SCORE[1]		41	54	43	43	36	54
OPTION RANK		3	1	2	2	4	1

[1] Total factor score derived by multiplying the factor rank by the access road option ranking and by summing the scores.

TABLE B.5

Consultants' Rankings of Options

LF-9C[1]

FACTORS	OPTION 1	OPTION 2	OPTION 3
EXISTING COMMUNITY & RECREATION FEATURES	3	2	1
EXISTING RESIDENTS	3	1	2
TRANSPORTATION SAFETY	3	2	1
EXISTING AGRICULTURAL RESOURCES	3	2	1
STREAM CROSSINGS	1	2	2
HYDROGEOLOGY	1	3	2

[1] Options ranked from most to least preferred (i.e. a 1 is the least preferred option).

TABLE B.6

Overall Ranking of Access Road Options

LF-9C

FACTORS	FACTOR RANK	OPTION 1	OPTION 2	OPTION 3
EXISTING AGRICULTURAL RESOURCES	3	9	6	3
EXISTING RESIDENTS	3	9	3	6
TRANSPORTATION SAFETY	3	9	6	3
EXISTING COMMUNITY & RECREATION FEATURES	2	6	4	2
STREAM CROSSINGS	2	2	4	4
HYDROGEOLOGY	1	1	3	2
TOTAL FACTOR SCORE[1]		36	26	20
OPTION RANK		1	2	3

[1] Total of factor score derived by multiplying the factor rank by the access road option ranking and by summing the scores.

TABLE B.7

Consultants' Rankings of Options

LF-1E[1]

FACTORS	OPTION 1	OPTION 2	OPTION 3	OPTION 4	OPTION 5
EXISTING COMMUNITY & RECREATION FEATURES	2	3	3	2	1
EXISTING RESIDENTS	3	2	4	3	1
TRANSPORTATION SAFETY	5	1	2	4	3
EXISTING AGRICULTURAL RESOURCES	2	3	1	5	4
STREAM CROSSINGS	2	2	2	2	1
HYDROGEOLOGY	2	3	3	2	1

[1] Options ranked from most to least preferred (i.e. a 1 is the least preferred).

TABLE B.8

Overall Ranking of Access Road Options

LF-1E

FACTORS	FACTOR RANK	OPTION 1	OPTION 2	OPTION 3	OPTION 4	OPTION 5
EXISTING AGRICULTURAL RESOURCES	3	6	9	3	15	12
EXISTING RESIDENTS	3	9	6	12	9	3
TRANSPORTATION SAFETY	3	15	3	6	12	9
EXISTING COMMUNITY & RECREATION FEATURES	2	4	6	6	4	2
STREAM CROSSINGS	2	4	4	4	4	2
HYDROGEOLOGY	1	2	3	3	2	1
TOTAL FACTOR SCORE[1]		40	31	34	46	29
OPTION RANK		2	4	3	1	5

---

[1] Total factor score derived by multiplying the factor rank by the access road option ranking and by summing the scores.

TABLE B.9

Consultants' Rankings of Options

PI-1N[1]

FACTORS	OPTION 1	OPTION 2
EXISTING COMMUNITY & RECREATION FEATURES	1	2
EXISTING RESIDENTS	2	1
TRANSPORTATION SAFETY	1	2
EXISTING AGRICULTURAL RESOURCES	1	2
STREAM CROSSINGS	1	1
HYDROGEOLOGY	2	1

[1] Options ranked from most to least preferred (i.e. a 1 is the least preferred option).

TABLE B.10

Overall Ranking of Access Road Options

PI-1N

FACTORS	FACTOR RANK	OPTION 1	OPTION 2
EXISTING AGRICULTURAL RESOURCES	3	3	6
EXISTING RESIDENTS	3	6	3
TRANSPORTATION SAFETY	3	3	6
EXISTING COMMUNITY & RECREATION FEATURES	2	2	4
STREAM CROSSINGS	2	2	2
HYDROGEOLOGY	1	2	1
TOTAL FACTOR SCORE[1]		18	22
OPTION RANK		2	1

[1] Total factor score derived by multiplying the factor rank by the access road option ranking and by summing the scores.

TABLE B.11

Consultants' Rankings of Options

PI-1N to LF-2N1

FACTORS	OPTION 1	OPTION 2
EXISTING COMMUNITY & RECREATION FEATURES	1	2
EXISTING RESIDENTS	2	1
TRANSPORTATION SAFETY	2	1
EXISTING AGRICULTURAL RESOURCES	1	2
STREAM CROSSINGS	1	2
HYDROGEOLOGY	2	1

1 Options ranked from most to least preferred (i.e. a 1 is the least preferred option).

TABLE B.12

Overall Ranking of Access Road Options

PI-1N to LF-2N

FACTORS	FACTOR RANK	OPTION 1	OPTION 2
EXISTING AGRICULTURAL RESOURCES	3	3	6
EXISTING RESIDENTS	3	6	3
TRANSPORTATION SAFETY	3	6	3
EXISTING COMMUNITY & RECREATION FEATURES	2	2	4
STREAM CROSSINGS	2	2	4
HYDROGEOLOGY	1	2	1
TOTAL FACTOR SCORE[1]		21	21
OPTION RANK		1	1

[1] Total factor score derived by multiplying the factor rank by the access road option ranking and by summing the scores.

TABLE B.13

Consultants' Rankings of Options

PI-13N[1]

FACTORS	OPTION 1	OPTION 2	OPTION 3
EXISTING COMMUNITY & RECREATION FEATURES	1	1	2
EXISTING RESIDENTS	3	2	1
TRANSPORTATION SAFETY	1	3	2
EXISTING AGRICULTURAL RESOURCES	1	3	2
STREAM CROSSINGS	1	2	1
HYDROGEOLOGY	3	2	1

[1] Options ranked from most to least preferred (i.e. a 1 is the least preferred option).

TABLE B.14

Overall Ranking of Access Road Options

PI-13N

FACTORS	FACTOR RANK	OPTION 1	OPTION 2	OPTION 3
EXISTING AGRICULTURAL RESOURCES	3	3	9	6
EXISTING RESIDENTS	3	9	6	3
TRANSPORTATION SAFETY	3	3	9	6
EXISTING COMMUNITY & RECREATION FEATURES	2	2	2	4
STREAM CROSSINGS	2	2	4	2
HYDROGEOLOGY	1	3	2	1
TOTAL FACTOR SCORE[1]		22	32	22
OPTION RANK		2	1	3

[1] Total factor score derived by multiplying the factor rank by the access road option ranking and by summing the scores.

TABLE B.15

Consultants' Rankings of Options

PI-13N to LF-2N[1]

FACTORS	OPTION 1	OPTION 2	OPTION 3	OPTION 4
EXISTING COMMUNITY & RECREATION FEATURES	2	3	3	1
EXISTING RESIDENTS	2	3	3	1
TRANSPORTATION SAFETY	2	3	4	1
EXISTING RESOURCES	3	1	4	2
STREAM CROSSINGS	1	1	1	1
HYDROGEOLOGY	2	4	3	1

[1] Options ranked from most to least preferred (i.e. a 1 is the least preferred option).

TABLE B.16

Overall Ranking of Access Road Options

PI-13N to LF-2N

FACTORS	FACTOR RANK	OPTION 1	OPTION 2	OPTION 3	OPTION 4
EXISTING RESOURCES	3	9	3	12	6
EXISTING RESIDENTS	3	6	9	9	3
TRANSPORTATION SAFETY	3	6	9	12	3
EXISTING COMMUNITY & RECREATION FEATURES	2	4	6	6	2
STREAM CROSSINGS	2	2	2	2	2
HYDROGEOLOGY	1	2	4	3	1
TOTAL FACTOR SCORE[1]		29	33	44	17
OPTION RANK		3	2	1	4

[1] Total factor score derived by multiplying the factor rank by the access road option ranking and by summing the scores.

TABLE B.17

Consultants' Rankings of Options

LF-4N[1]

FACTORS	OPTION 1	OPTION 2
EXISTING COMMUNITY & RECREATION FEATURES	1	1
EXISTING RESIDENTS	2	1
TRANSPORTATION SAFETY	1	2
EXISTING RESOURCES	1	2
STREAM CROSSINGS	1	1
HYDROGEOLOGY	1	1

[1] Options ranked from most to least preferred (i.e. a 1 is the least preferred option).

TABLE B.18

Overall Ranking of Access Road Options

LF-4N

FACTORS	FACTOR RANK	OPTION 1	OPTION 2
EXISTING RESOURCES	3	3	6
EXISTING RESIDENTS	3	6	3
TRANSPORTATION SAFETY	3	3	6
EXISTING COMMUNITY & RECREATION FEATURES	2	2	2
STREAM CROSSINGS	2	2	2
HYDROGEOLOGY	1	1	1
TOTAL FACTOR SCORE[1]		17	20
OPTION RANK		2	1

[1] Total factor score derived by multiplying the factor rank by the access road option ranking and by summing the scores.

TABLE B.19

Consultants' Rankings of Options

PI-27E to LF-1E[1]

FACTORS	OPTION 1	OPTION 2	OPTION 3	OPTION 4	OPTION 5
EXISTING COMMUNITY & RECREATION FEATURES	2	3	3	2	1
EXISTING RESIDENTS	3	2	4	3	1
TRANSPORTATION SAFETY	5	1	2	4	3
EXISTING RESOURCES	2	3	1	5	4
STREAM CROSSINGS	2	2	2	2	1
HYDROGEOLOGY	2	3	3	2	1

---

[1] Options ranked from most to least preferred (i.e. a 1 is the least preferred option).

TABLE B.20

Overall Ranking of Access Road Options

PI-27E to LF-1E

FACTORS	FACTOR RANK	OPTION 1	OPTION 2	OPTION 3	OPTION 4	OPTION 5
EXISTING RESOURCES	3	6	9	3	15	12
EXISTING RESIDENTS	3	9	6	12	9	3
TRANSPORTATION SAFETY	3	15	3	6	12	9
EXISTING COMMUNITY & RECREATION FEATURES	2	4	6	6	4	2
STREAM CROSSINGS	2	4	4	4	4	2
HYDROGEOLOGY	1	2	3	3	2	1
TOTAL FACTOR SCORE[1]		40	31	34	46	29
OPTION RANK		2	4	3	1	5

[1] Total factor score derived by multiplying the factor rank by the access road option ranking and by summing the scores.

TABLE B.21

Factors Used in Phase 4A Analysis of Access Route Options

FACTOR GROUPING	FACTOR	INDICATOR	RATIONALE FOR FACTOR
A. RISK			
• Transportation Risk	• accident probability and safety of transport (along preferred access routes from 400 series highway to site)	• composite annual accident rate (acc./mil. veh. km.) • number of public intersections where a turn is required • peak hour volume to capacity ratio	• the possibility of an accident is dependent upon the existing characteristics of the routes used. An analysis of the access route options in terms of their safety and historical accident rate will be an input to the route selection process.
	• number and characteristics of people along access routes	• population concentrations • number and characteristics of populations using community and recreation features	• residents living along access roads at increased risk in the event of a transportation accident or spill of untreated waste.
	• operations of community and recreation features	• number and characteristics of community and recreation features	• community and recreation features and users along access roads at increased risk in event of a transportation accident or spill of untreated waste.
	• transportation risk to surface water	• stream length through land with sensitive water use	• there is a possibility of an accidental release of hazardous wastes during transit. Surface waters provide a pathway for the rapid movement of contaminants from the

TABLE B.21

Factors Used in Phase 4A Analysis of Access Route Options

FACTOR GROUPING	FACTOR	INDICATOR	RATIONALE FOR FACTOR
A. RISK			
• Transportation Risk (cont'd)		• length of access route at high risk of waste entry to a stream in the event of a transportation spill (m)	spill site. An increased risk to human health and the restriction of use of downstream surface water could occur as a result of a transportation spill.
B. ENVIRONMENTAL IMPACTS			
• Residents	• displacement of residents	• number of residents	• residents who are displaced by the widening of an access road may experience social effects. For example, they may lose friendship and community ties; they may become alienated in their new location; and they may experience stress and anxiety at the disruption of their way of life.
	• disruption of day-to-day activities and/or the use and enjoyment property	• number of residents	• residents living along access routes may find that their daily activities and the use and enjoyment of their properties is affected by the operation of the OWMC facility. • residents may experience disruption due to nuisance effects of dust and noise and reduced accessibility.
• Community Facilities and Services	• displacement of community and recreation features	• number and characteristics of community and recreation features	• the displacement of community and recreation features may cause hardship to clients and reduce social stability and cohesion by causing changes in the commitment of residents to the community and in patterns of resident interaction.

TABLE B.21

Factors Used in Phase 4A Analysis of Access Route Options

FACTOR GROUPING	FACTOR	INDICATOR	RATIONALE FOR FACTOR
B. ENVIRONMENTAL IMPACTS			
• Community Facilities and Services (cont'd)	• disruption of operations of community and recreation features	• number and characteristics of community and recreation features	• the operation of certain community services and facilities may be negatively affected by changes in noise levels, dust, odour, truck traffic or other such environmental changes caused by the waste management facility. This may result in a loss of operational effectiveness of the service or facility which in turn could lead to a loss of demand for the service. The proximity of the feature to the access routes may also be seen to detract from the attractiveness or image of the service or facility which in turn could also result in a loss of demand.
• Land Use Impacts	• existing land use	• existing land use pattern • number of residences • number of commercial facilities	• this factor addresses the compatibility of existing land uses with the proposed facility siting. The relative degree of land use compatibility or conflict will be assessed based upon the nature and extent of existing residential and commercial land uses.
	• proposed and planned land use	• land use designations • unapproved development proposals • vacant lots of record	• this factor addresses the compatibility of future, planned and proposed land uses with the proposed facility. The relative degree of land use compatability of conflict in the future will be predicted based upon the nature and extent of future land use designations. This factor is intended to

TABLE B.21

Factors Used in Phase 4A Analysis of Access Route Options

FACTOR GROUPING	FACTOR	INDICATOR	RATIONALE FOR FACTOR
B. ENVIRONMENTAL IMPACTS			
• Land Use Impacts (cont'd)		° local official plan policies ° regional official plan policies	account for the different types and rates of growth which can occur along potential access roads to candidate sites.
• Agricultural Resources	° farm businesses along access roads	° farm machinery movements (km/year) ° livestock housed (animal units - livestock and poultry) ° number of cattle crossings/year ° number of service vehicles stops/year ° number of customer stops/year ° loss of land (class 1 equivalent)(ha) ° area of crops within 800 m (ha)	° disruption to farm operations will occur to farms along access routes to the OWMC facility as a result of road widenings, higher levels of traffic and the risk of accidental spills and environmental damage by wastes. ° indicators were selected to reflect both types of impact.

TABLE B.21

Factors Used in Phase 4A Analysis of Access Route Options

FACTOR GROUPING	FACTOR	INDICATOR	RATIONALE FOR FACTOR
B. ENVIRONMENTAL IMPACTS			
• Natural Environment	° transportation impact on fish communities	° length of locally significant fishery	° there is a possibility of an accidental release of hazardous wastes during transit. Surface waters provide a pathway for the rapid movement of contaminants from the spill site.
		° length of regionally significant fishery	° this factor recognizes that there is potential for impact on downstream fish populations in the event of an accidental spill of untreated waste along an access road.
C. COST			
• Transportation Costs	° road improvement costs	° road improvement construction costs (000s of dollars)	° third ranked goal of OWMC is to minimize cost to OWMC and the people of Ontario.
		° right-of-way required (ha)	° all others things being equal, the access roads with lowest road improvement costs preferred.

TABLE B.22

Summary of Consultants' Ranking of Factors – Phase 4A Analysis of Access Road Options

CONSULTANT	AREA OF RESPONSIBILITY	FACTORS	RANKING OF FACTORS	RATIONALE FOR RANKING
M.M. Dillon	Transportation	° accident probability and safety of transport ° road improvement costs	° accident risk factor ranked higher than transportation cost factor	° risk to human health is the most important goal ° relates directly to the safety of each local and regional access route ° cost is lowest ranked goal of OWMC ° minor consideration in selection of preferred access road
Institute of Environmental Research	Social Analysis	° displacement of residents ° disruption of day-to-day activities and use and enjoyment of property ° displacement of community and recreation features	most important ↑	° no residents or features displaced ° greatest weight given to adjacent residents and features ° impact categories derived based on number of adjacent residents and community and recreation features

TABLE B.22

Summary of Consultants' Ranking of Factors – Phase 4A Analysis of Access Road Options

CONSULTANT	AREA OF RESPONSIBILITY	FACTORS	RANKING OF FACTORS	RATIONALE FOR RANKING
Institute of Environmental Research (cont'd)	Social Analysis (cont'd)	° disruption of operation of community and recreation features	↓ least important	
Leon Kentridge Associates Ltd.	Land Use	° existing land use ° planned and proposed land use	° factors ranked equal	° both factors equally important in terms of defining potential land use impacts along access roads

TABLE B.23

Access Roads - LF-3C[1]
Consultants' Ranking of Options

	FACTOR	OPTION 1	OPTION 6
° Transportation Risk	° accident probability and safety	1	2
	° number of residents	1	2
	° operations of community and recreation features	2	1
	° transportation risk to surface water	2	1
° Environmental Impacts	° disruption of day-to-day activities and/or the use and enjoyment of property	1	2
	° disruption of operations of community and recreation features	1	1
	° farm businesses along access roads	1	2
	° impact on fish communities	2	1
° Cost	° road improvement costs	2	1

[1] Options ranked from most to least preferred (i.e. a 1 is the least preferred option).

TABLE B.24

Overall Ranking of Access Road Options LF-3C

	FACTOR	FACTOR RANK	OPTION 1	OPTION 6
° Transportation Risk	° accident probability and safety	5	5	10
	° number of residents	5	5	10
	° operations of community and recreation features	3	3	3
	° transportation risk to surface water	2	4	2
° Environmental Impacts	° disruption of day-to-day activities and/or the use and enjoyment of property	5	5	10
	° disruption of operations of community and recreation features	3	3	3
	° farm businesses along access roads	4	4	8
	° impact on fish communities	2	4	2
° Cost	° road improvement costs	1	2	1
Total Factor Score[1]			35	49
Option Rank			2	1

[1] Total factor score derived by multiplying the factor rank by the access road option ranking and by summing the scores.

TABLE B.25

Access Roads - LF-1E[1]
Consultants' Ranking of Options

	FACTOR	OPTION 1	OPTION 3	OPTION 6	OPTION 7
° Transportation Risk	° accident probability and safety	2	4	3	1
	° number of residents	1	1	1	1
	° operations of community and recreation features	1	1	1	1
	° transportation risk to surface water	2	3	4	1
° Environmental Impacts	° disruption of day-to-day activities and/or the use and enjoyment of property	1	1	1	1
	° disruption of operations of community and recreation features	1	1	1	1
	° farm businesses along access roads	1	4	3	2
	° impact on fish communities	2	3	4	1
° Cost	° road improvement costs	2	1	1	2

---

[1] Options ranked from most to least preferred (i.e. a 1 is the least preferred option).

TABLE B.26

Overall Ranking of Access Road Options
LF-1E

	FACTOR	FACTOR RANK	OPTION 1	OPTION 3	OPTION 6	OPTION 7
° Transportation Risk	° accident probability and safety	5	10	20	15	5
	° number of residents	5	5	5	5	5
	° operations of community and recreation features	3	3	3	3	3
	° transportation risk to surface water	2	4	6	8	2
° Environmental Impacts	° disruption of day-to-day activities and/or the use and enjoyment of property	5	5	5	5	5
	° disruption of operations of community and recreation features	3	3	3	3	3
	° farm businesses along access roads	4	4	16	12	8
	° impact on fish communities	2	4	6	8	2
° Cost	° road improvement costs	1	2	1	1	2
Total Factor Score[1]			40	65	60	35
Option Rank			3	1	2	4

[1] Total factor score derived by multiplying the factor rank by the access road option ranking and by summing the scores.

TABLE B.27

Access Roads - PI-1N to LF-4N[1]
Consultants' Ranking of Options

	FACTOR	OPTION 1	OPTION 2
° Transportation Risk	° accident probability and safety	1	2
	° number of residents	1	2
	° operations of community and recreation features	1	2
	° transportation risk to surface water	1	1
° Environmental Impacts	° disruption of day-to-day activities and/or the use and enjoyment of property	1	2
	° disruption of operations of community and recreation features	1	2
	° farm businesses along access roads	2	1
	° impact on fish communities	1	2
° Cost	° road improvement costs	2	1

[1] Options ranked from most to least preferred (i.e. a 1 is the least preferred option).

TABLE B.28

Access Roads - PI-27E[1]
Consultants' Ranking of Options

	FACTOR	OPTION 1	OPTION 2
° Transportation Risk	° accident probability and safety	1	2
	° number of residents	1	1
	° operations of community and recreation features	1	1
	° transportation risk to surface water	1	1
° Environmental Impacts	° disruption of day-to-day activities and/or the use and enjoyment of property	1	1
	° disruption of operations of community and recreation features	1	1
	° farm businesses along access roads	1	1
	° impact on fish communities	1	2
° Cost	° road improvement costs	2	1

[1] Options ranked from most to least preferred (i.e. a 1 is the least preferred option).

APPENDIX C

(APPENDIX TO CHAPTER 5)

RATIONALE FOR ACCESS ROAD
IMPACT ZONE EMPLOYED IN
THE COMPARATIVE EVALUATION OF OPTIONS

1.0 INTRODUCTION

The greatest potential impact involved with truck transport of flammable waste materials would be a fire or explosion resulting from an accident. An impact zone of 800 m on either side of the access road was employed in the Phase 4A comparative evaluation of access road options. The 800 m zone is based on a United States Department of Transport guideline which recommends this isolation distance for spills involving many flammable substances.

The following document entitled Zone of Influence Around Transportation Routes provides technical details used to derive the impact zone.

ZONE OF INFLUENCE AROUND TRANSPORTATION ROUTES

9495-22
July 1984

DILLON
Consulting Engineers & Planners

OUR FILE: 9495-22
YOUR FILE:

12 July 1984

Ontario Waste Management Corporation
2 Bloor Street West
11th Floor
Toronto, Ontario
M4W 3E2

ATTENTION: Mr. D.P. Lawrence, M.C.I.P.

Zones of Influence for
Transportation Incidents

Dear Sirs:

As you requested, we are enclosing a discussion of the "Zone of Influence" surrounding the scene of a transportation accident. The wastes discussed pose hazards due to fire, inhalation of toxic solvent fumes, and inhalation of toxic reaction products.

Yours truly,

M.M. DILLON LIMITED

J.D.R. McEwen, P.Eng.
for J.R. Crosby, P.Eng.
Project Manager

JDRM:jmm
Encl.

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EXECUTIVE SUMMARY

For waste hauling vehicle routes, the largest hazard zone area results from an incident involving a tank trailer of flammable (non-halogenated) solvent involving fire. For such an incident, an isolation radius of 800 m has been recommended.

Hazard zones for other spill scenarios are smaller, ranging from 50 m to 350 m in length.

CHAPTER 1
ZONE OF INFLUENCE AROUND TRANSPORTATION ROUTES

1. INTRODUCTION

The transportation of wastes of many kinds to the OWMC facility results in a finite probability of some road accident involving waste-hauling vehicles. Depending on the vehicle contents, a hazardous condition may occur. In the case of a single truck carrying flammable materials, injury or damage from fire or explosion may be the major hazard. If the cargo is volatile toxic material, the hazard may be from inhalation of the vapours. Where two trucks are involved, the hazard may be due to reaction between the spilled contents. In this discussion both single-vehicle and two-vehicle incidents will be considered.

It is assumed that common configurations of truck and trailer are used, and, as a worst case, that the largest volume common containers are involved in the triggering incident. This is a 30 000 kg tank trailer (GVW 47 500 kg) (Pilorusso 1983).

CHAPTER 2

ZONE OF INFLUENCE FOR INCIDENTS INVOLVING SPECIFIC WASTES

1. SINGLE TRUCK SPILLS

1.1 WASTE FLAMMABLE SOLVENT: SINGLE TRUCK SPILL

Evacuation or isolation zones have been estimated for accidents involving tank cars or tank trucks of flammable solvents. Such solvents could include waste hydrocarbon solvents such as naphtha or mineral spirits, which might result from cleaning or degreasing operations. The Transport Canada Information and Emergency Centre (CANUTEC) does not make general recommendations for evacuation distances for flammable solvent incidents, since general recommendation may be inappropriate in specific circumstances (Pers. Commun., CANUTEC).

The United States Department of Transport has published guidelines for responses to spills of various materials (Emergency Response Guidebook 1984). This guidebook recommends isolation distances for spills involving certain flammable substances. The evacuation or isolation distance recommended is 800 m (1/2 mile) for most non-halogenated organic liquids, including solvent classes such as:

- toluene
- xylene
- petroleum naphtha
- solvent naphtha
- distillate naphtha
- petroleum oil

- petroleum distillate
- petroleum crude oil
- thinner
- turpentine
- turpentine substitute

as well as gasoline. Since some of the solvent wastes to be received by OWMC will fall into these categories, the isolation area to be considered should be 800 m or 1/2 mile.

It may also be noted that this isolation distance is, in large measure, due to the explosion hazard associated with tank truck or tank car fires. The situation at a road accident is, in this way, considerably different from that in a plant environment. A tank vehicle is essentially a sealed container, and is susceptible to rupturing and forming a massive fireball under fire conditions. At a road incident, there is generally a time lag before countermeasures and fire equipment can be brought to bear. This time lag can permit a fire and spill situation to deteriorate severely.

In a plant situation, vehicle velocities are lower, so that incidents are less likely to be catastrophic; stationary tanks are designed and constructed in accordance with standards that minimize the potential for rupture due to fire or impact; and plant design includes emergency control measures, including fire fighting and prevention equipment and spill containment.

1.2 WASTE HALOGENATED SOLVENT: SINGLE TRUCK SPILL

For this case it is assumed that:

1. A 30 000 kg load of waste 1,1,1-trichloroethane (the most volatile common chlorinated solvent) is involved in a spill. Since the density of this solvent is 1.34 gm/mL, this corresponds to a volume of 22.5 m^3.

2. The incident results in a hole in the tank, through which the solvent leaks until the leak is repaired or the tank is drained. Here it is assumed that it will taken 1/2 hour from the occurrence of the incident to begin repairing the leak and/or containing the spill.

3. The conditions at the site may be day or night, clear or overcast. "Normal Canadian weather conditions" prevail - "neutral" to "moderately stable", corresponding to daytime conditions of moderate solar radiation and winds of 5 m/s or over, and night conditions of winds of 3 m/s or less and cloudy. Average wind speed for this region is about 4.5 m/s.

The liquid venting rate is described by the relationship:

$$q = AC_d\rho_l\sqrt{2gH + \frac{2(P-Pa)}{\rho_l}} \qquad \text{(Phani)}$$

where q = instantaneous liquid vent rate, g/s
H = height of liquid column above hole, cm
P = tank pressure, Pa
A = Area of rupture, cm^2
C_d = coefficient of discharge = 0.8
ρ_l = density of liquid, g/cm^3
g = acceleration due to gravity = 981 cm/s^2
Pa = atmospheric pressure = 101.3 kPa

It can be seen that the liquid will escape from a 50 mm hole in the bottom of a tank initially at 12 kg/s (720 kg/min) and from a 150 mm hole at about 110 kg/s (6600 kg/min). The discharge rate for a 150 mm hole will be reduced only to about 45 kg/s when the tank is 3/4 empty, which will occur within a few minutes. For such a scenario, in which a tank trailer has a 150 mm puncture in the bottom, the liquid will be substantially all spilled before any containment occurs.

It is likely that the spill site will have either some gradient, so that a pool will form, or that it will drain into a ditch or swale by the road, or will be confined by curbs, or will soak into the soil or road bed. The road bed is assumed to be constructed to Ontario Ministry of Transportation and Communications specifications (MTC 1983) using "Granular A", which is over 90% sand and larger size particles as classified by the United States Department of Agriculture Soil Classification System (SCS 1967). Such material has a permeability ranging from 10^{-3} to 1.0 cm/s (Terzaghi 1967). Because of the high gravel content, it is expected to be near the high end of this range. This agrees reasonably well with the estimate for permeability for coarse sand given in the TIPS series (TIPS 1982) of 10^{-2} m/s or 1 cm/s, equivalent to an intrinsic permeability of 10 m^{-2}.

At the initial spill rate of 110 L/s, the trichlorethane would flow over only a small area of a few square metres, before permeating into the road bed. Bearing these factors in mind, an exposed area of 100 m^2 is considered to be a conservative maximum pool area.

The evaporation from such a pool is considered to follow the relationship:

$$Q = \frac{K\ A\ P\ M}{R\ T}$$ (Stiver and MacKay 1982)

where K = mass transfer coefficient = $0.002\ U^{.78}$, m/s
U = wind speed, m/s
A = area of spill surface, m^2
P = vapour pressure, kPa
M = molecular weight = 133.5 g/mole
R = gas constant = 8.314 (Pa)(m^3)($mole^{-1}$)($°K^{-1}$)
T = temperature, °K

Using this relationship, evaporation rates were calculated for the following conditions:

	Time of Day/ Weather	Temperature °K	Wind Speed m/s	Evaporation Rate g/s/m^2
1.	Daytime - Sunny	30	2.0	3.8
2.	Day or Night - Overcast	30	4.5	7.2
3.	Day or Night - Overcast	30	6.0	9.0
4.	Night - Stable	20	3.0	3.4

Relationships have been developed (TIPS 1982) for estimating the concentration of contaminants downwind from emission sources using a Gaussian plume equation. The basic relationship is independent of the chemical species and, with appropriate normalizing adjustments, may be used for 1,1,1-trichloroethane.

For the conditions given above, the ACGIH TLV® (ACGIH) for 1,1,1-trichloroethane may be exceeded for a maximum downwind distance of 350 m. This occurs under condition 4.

It is considered that the isolation zone in this case should be the zone over which the American Conference of Governmental Industrial Hygienists 8-hour TLV® is exceeded at any time. This will include the area near the spill, where the levels are high longer, and the areas at the fringe of the zone, where the TLV® may be exceeded only briefly. The 8-hour TLV® is considered a suitable criterion because:

a) It is a safe limit for a lifetime of exposure for 8 hours per day. In a spill context it should be quite conservative. An 8-hour day is likely to approximate the clean-up and control time, so that those near the fringes of the affected area will not receive near-TLV® exposure for more than 8 hours.

b) The short-term exposure limit, based on 15 minutes exposure, is inappropriate because the time over which the concentration exceeds this value is likely to last considerably more than 15 minutes under some circumstances.

c) The MOE limit is an emissions limit, suitable for fixed-plant applications and presupposing continuous emission over, perhaps, many years. A spill site is a one-time short-term emergency case.

2. TWO-TRUCK INCIDENTS

2.1 INTRODUCTION

A spill event involving two tractor trailers carrying 30 000 kg of incompatible liquid wastes is considered as a worst case. In such an event, both trailers could be ruptured and the incompatible liquids mixed. This is considered to be a more hazardous case than the mixing of an incompatible liquid and solid, since solid and liquid would not be as readily mixed in a spill incident as two liquids.

2.2 CYANIDE-ACID REACTION

Consider two trucks containing 30 000 kg of waste acid and 30 000 kg of cyanide waste, with a cyanide content equivalent to 0.5% sodium cyanide. The acid content of an acid waste is considered to be much higher than that required to react with all the cyanide in the cyanide waste.

In the case of a spill involving these vehicles, a rupture or puncture equivalent to 150 mm (6 in.) diameter, in the bottom of the cyanide tank would result in a release rate of:

$$q = AC_d\rho_\ell\sqrt{2gH + \frac{2(P-Pa)}{\rho_\ell}}$$

where q = instantaneous liquid vent rate, g/s
H = height of liquid column above hole, cm
P = tank pressure = 101300 Pa (1 atmosphere)
A = area of rupture = 179 cm^2 (150 mm hole)
C_d = coefficient of discharge = 0.8
ρ_ℓ = density of liquid, 1.05 g/mL
g = acceleration due to gravity = 981 cm/s^2
Pa = atmospheric pressure = 101300 Pa

so that q = 93 135 g/s, equivalent to 466 g/s sodium cyanide.

Assuming sufficient acid is also released to react with this solution (requiring a similar puncture in the acid tank), the instantaneous hydrogen cyanide release rate may be calculated from the relationship below.

$$NaCN + H^+ \longrightarrow HCN + Na^+$$

The formula weight of sodium cyanide is 49 , and that of hydrogen cyanide is 27, so the release rate for hydrogen cyanide is thus 257 g/s.

The 8-hour TLV® (ACGIH) for hydrogen cyanide is 10 mg/m^3, so using the same methods as those employed in Section 1.2, the downwind "plume" area where the TLV® is exceeded is estimated to be approximately 0.3 km long. The width of the plume would be about 100 m.

2.3 SULFIDE-ACID REACTION

Similarly, a truck containing sulfide waste, equivalent to 0.1% sodium sulfide, under the same spill circumstances as cited in Section 2.2, would release hydrogen sulfide at a rate of 41 g/s. The TLV® of hydrogen sulfide is 14 mg/m^3 (ACGIH). The area over which the TLV® would be exceeded would be 50 m downwind by about 20 m wide.

3. CONCLUSION

The largest impact expected from of a road accident involving waste vehicles would be due to fire and explosion hazard associated with a full trailer load of waste non-halogenated solvent. The distance affected is the recommended isolation distance for a flammable liquid tanker spill incident, or 800 m radius around the spill. This area may be affected immediately by a spill.

A 350 m affected zone will result from a solvent spill, but the affected zone will be much narrower and will be downwind of the spill only. Probable emission rates from mixed reactive chemicals result in considerably smaller plumes.

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APPENDIX D

(APPENDIX TO CHAPTER 6)

APPENDIX D

INTRODUCTION

Appendix D consists of the following tables:

Table D.1 - Rail Access Factors Used in Constraint Mapping

Table D.2 - Summary of Consultants' Ranking of Factors - Rail Access Constraint Mapping

Table D.3 - Phase 4A - Rail Access Options - Comparative Analysis

Table D.4 - Rail Access - Factors Used in Comparative Evaluation of Options

Table D.5 - Summary of Consultants' Ranking of Factors - Comparative Evaluation of Rail Access Options

Table D.6 - Rail Access - Comparison of Constraint Mapping and Comparative Evaluation Factors

Tables D.1 and D.4 provide the factors and a rationale for the factors employed in constraint mapping and the comparative evaluation of options, respectively.

Tables D.2 and D.5 provide the consultants' ranking of factors and a rationale for the ranking for constraint mapping and the comparative evaluation of options, respectively.

Table D.3 provides the data employed in the comparative evaluation of rail access options.

TABLE D.1

Rail Access

Factors Used in Constraint Mapping

Factors	Rationale for Factors
Transportation	
° range of limitations for service	° used to identify broad corridors for constraint mapping exercise
° construction cost (for LF-2N & PI-13N)	° cost of each rail access option will include the costs associated with constructing a rail line to connect the candidate site to the main rail line
° road crossings (for LF-2N & PI-13N)	° transportation safety along roadways near the candidate site may be affected by the introduction of level railway crossings
Biology	
° significant environmental units (SEUs)	° relates to the objective of minimizing impacts on the natural environment ° areas may perform significant environmental functions or contain significant environmental features
° non-SEU woodlots greater than 20 ha	° documents the presence of a vegetation unit which may have value as a forestry or recreational resource or may provide wildlife habitat ° flags areas with potential for significance
Surface Water	
° number of stream crossings	° watercourses could provide pathway for rapid movement of reagents in the event of a spill
Social/Land Use	
° estimated population	° construction of rail line could result in displacement of residents

TABLE D.1

Rail Access

Factors Used in Constraint Mapping

Factors	Rationale for Factors
Social/Land Use (cont'd)	
° estimated population (cont'd)	° use of rail line could affect the normal use and enjoyment of residential properties ° rail options which minimized the number of residents displaced or disrupted preferred
° community and recreation features	° construction of a rail line could result in the displacement of community and recreation features ° use of rail line could disrupt operations of features in vicinity of rail line ° desirable to minimize the number of features displaced or disrupted
° existing residences and clusters of residences	° residential land uses incompatible with OWMC facility and/or rail line
° existing commercial and industrial facilities	° provides an indication of impact on industrial and commercial uses and relative compatibility with OWMC facilities
° residential land use designations	° provides an indication of a community's intent regarding future land use ° residential land uses incompatible with OWMC facility and/or rail line
Agriculture	
° proximity to farm buildings	° active farm buildings used to indicate viable farm operations ° rail alignments should not be in close proximity to these buildings ° noise and risk of accident could interfere with farm activities

TABLE D.1

Rail Access

Factors Used in Constraint Mapping

Factors	Rationale for Factors
Agriculture (cont'd)	
° severance of farm parcels	° severances may create small inefficient fields or restrict farm machinery access to fields
° cropland	° land currently used for crop production is an indicator of the potential for agricultural impact ° best to avoid cropped land

TABLE D.2

Summary of Consultants' Ranking of Factors - Rail Access Constraint Mapping

Consultant	Area of Responsibility	Factors	Ranking of Factors	Rationale for Ranking
Gartner Lee Associates Ltd.	Biology	° significant environmental units (SEUs)	° high constraint	° fragmentation of an SEU by a rail line is expected to create an environmental impact through habitat displacement
		° non-SEU woodlots greater than 20 ha	° medium constraint	° these areas have potential for providing habitat for woodland species
Leon Kentridge Associates	Land Use	° existing residences and clusters of residences	° high constraint	° potential negative impacts from noise and general disruption associated with rail operations
		° existing commercial and industrial facilities	° moderate constraint	° these uses considered less sensitive to noise and other disruptive impacts than residential uses
		° residential land use designations	° low constraint	° with the exception of LF-2N, future residential development is not planned near any of the candidate sites
Ecologistics Ltd.	Agricultural Resources	° proximity to farm buildings		° number of barns adjacent to rail line indicates the potential for direct impacts to farm operations

TABLE D.2

Summary of Consultants' Ranking of Factors - Rail Access Constraint Mapping

Consultant	Area of Responsibility	Factors	Ranking of Factors	Rationale for Ranking
Ecologistics Ltd. (cont'd)	Agricultural Resources	- commercial farm buildings in average or above average condition	° high impact	° the condition of farm buildings was used as a general indication of the impact potential
		- hobby or horse farm	° moderate impact	
		- unused or derelict	° low impact	
		° severance of farm parcels		° rail alignment may sever farm properties
		- greater than 50 ha	° high impact	° creation of small fields which are inefficient to farm with existing machinery and which restrict machinery access to fields, are undesirable if crossings are not provided
		- 12-50 ha	° moderate impact	
		- less than 12 ha	° low impact	° routes with fewest number of farm severances and smallest fields severed preferred
		° cropland		
		- speciality crops	° very high impact	° indicates the potential for impact to land being used for crop production

TABLE D.2

Summary of Consultants' Ranking of Factors - Rail Access Constraint Mapping

Consultant	Area of Responsibility	Factors	Ranking of Factors	Rationale for Ranking
Ecologistics Ltd. (cont'd)	Agricultural Resources	- speciality crops	° very high impact	° corridor should be avoided
		- other cropland	° moderate impact	° potential impacts greater for routes with cropland than for routes through lands not cropped
		- not cropped	° low impact	

TABLE D.3

Phase 4A - Rail Access Options - Comparative Analysis

LF-4N

FACTORS OPTIONS	1	2	3	4
Transportation				
° crossing of provincial highways, regional roads and local roads (conflict index; where applicable only)	1 regional road	1 regional road	1 regional road	
° intersection/rail crossing separation distance (m)	>240	>240	>240	<180
Hydrogeology				
° distance through hydrogeologically sensitive lands (m)	0	0	0	0
Biology				
° SEUs (constraint level)	-	-	-	-
° non-SEU woodlots greater than 20 ha (constraint level)	-	-	-	-
° fish and wildlife features of significance (constraint level)	-	-	-	-
° rare species (constraint level)	-	-	-	-

TABLE D.3

Phase 4A - Rail Access Options - Comparative Analysis

LF-4N

FACTORS OPTIONS	1	2	3	4
Surface Drainage				
° number of stream crossings	2	2	1	1
° number of floodplains, floodprone areas and wetlands	0	0	0	0
Socio-Economic/Land Use				
° number of residences	0	0	1 (170 m)	0
° number and type - commercial and industrial uses	0	0	0	0
° displacement of community and recreation features	0	0	0	0
° disruption of operations of community and recreation features	0	0	0	0
° displacement of residents	0	0	0	0
° disruption of day-to-day activities and/or the use and enjoyment of property[1]	0	0	4 (170 m) 4 (250 m)	0

[1] The figures given for 250 m include the residents within the 170 m impact zone.

TABLE D.3

Phase 4A - Rail Access Options - Comparative Analysis

LF-4N

FACTORS OPTIONS	1	2	3	4
Agriculture				
° proximity to farm buildings (number of building complexes) (within 500 m zone)	1	0	0	0
° amount of cropland affected (within 500 m zone) (ha)	50	48	44	41
° severance of farm parcels (number and severity)	0	0	0	low
° loss of farmland (Class 1 equivalents) (ha)	1.0	0.8	0.8	0.8
Engineering				
° site size	° facility oriented on E-W axis	° facility oriented on N-S axis	° facility oriented on E-W axis	° facility oriented on N-S axis
° landfill life	° least interference with landfill development	° interferes with landfill development	° interferes with landfill development	° interferes with landfill development

TABLE D.3

Phase 4A - Rail Access Options - Comparative Analysis

LF-4N

FACTORS OPTIONS	1	2	3	4
Engineering (cont'd)				
° off-site facilities	° shortest rail spur required	° long rail spur required	° short rail spur required but has to cross floodplain area	° rail spur line has to cross low lying swampy area
° off-site land acquisition required (ha)	0.81	0.85	0.77	
° cost of rail infrastructure from mainline to site facility ($ million) (spur line length)	1.348 (1780 m)	1.842 (2540 m)	1.283 (1680 m)	

TABLE D.3

Phase 4A - Rail Access Options - Comparative Analysis

PI-1N

FACTORS OPTIONS	1	2	3	4
Transportation				
° crossing of provincial highways, regional roads and local roads (conflict index; where applicable only)	1 local road - access route	1 local road	1 local road	1 local road
° intersection/rail crossing separation distance (m)	>240	>240	>240	>240
Hydrogeology				
° distance through hydrogeologically sensitive lands (m)	0	0	0	0
Biology				
° SEUs (constraint level)	-	-	-	-
° non-SEU woodlots greater than 20 ha (constraint level)	-	-	-	-
° fish and wildlife features of significance (constraint level)	-	-	-	-

TABLE D.3

Phase 4A - Rail Access Options - Comparative Analysis

PI-1N

FACTORS OPTIONS	1	2	3	4
Biology (cont'd)				
° rare species (constraint level)	-	-	-	-
Surface Drainage				
° number of stream crossings	2	0	0	2
° number of floodplains, floodprone areas and wetlands	0	0	0	1
Socio-Economic/Land Use				
° number of residences	0	0	2 (250 m)	2 (250 m)
° number and type - commercial and industrial uses	0	0	0	0
° displacement of community and recreation features	0	0	0	0
° disruption of operations of community and recreation features	° Hunterbrook Farms	0	0	0

TABLE D.3

Phase 4A - Rail Access Options - Comparative Analysis

PI-1N

FACTORS OPTIONS	1	2	3	4
Socio-Economic/Land Use (cont'd)				
° displacement of residents	0	0	0	0
° disruption of day-to-day activities and/or the life and enjoyment of property[1]	0	0	4 (170 m)	4 (170 m)
Agriculture				
° proximity to farm buildings (number of building complexes) (within 500 m zone)	1	0	0	1
° amount of cropland affected (within 500 m zone) (ha)	60	24	10	14
° severance of farm parcels (number and severity)	0	0	0	0
° loss of farmland (Class 1 equivalent) (ha)	1.2	0.5	0.6	0.6

[1] The figures given for 250 m include the residents within the 170 m impact zone.

TABLE D.3

Phase 4A - Rail Access Options - Comparative Analysis

PI-1N

FACTORS OPTIONS	1	2	3	4
Engineering				
° site size	° facility oriented on N-S axis	° facility oriented on N-S axis	° facility oriented on N-S axis	° facility oriented on N-S axis
° landfill life	N/A	N/A	N/A	N/A
° off-site facilities	° longer rail spur required	° shortest rail spur required	° short rail spur required	° short rail spur required
° off-site land acquisition required (ha)	1.15	1.21	1.28	1.35
° cost of rail infrastructure from mainline to site facility ($ million) (spur line length)	1.074 (1780 m)	0.944 (1250 m)	1.166 (1500 m)	1.381 (1830 m)

TABLE D.3

Phase 4A - Rail Access Options - Comparative Analysis

LF-3C

FACTORS OPTIONS	1	2	3
Transportation			
° crossing of provincial highways, regional roads and local roads (conflict index; where applicable only)	1 regional road	1 regional road	
° intersection/rail crossing separation distance (m)	>240	>240	<180
Hydrogeology			
° distance through hydrogeologically sensitive lands (m)	0	0	0
Biology			
° SEUs (constraint level)	° separated small portion of SEU 18-10 (S.W. Elcho Forest) (M)	-	-
° non-SEU woodlots greater than 20 ha (constraint level)	-	-	-

TABLE D.3

Phase 4A - Rail Access Options - Comparative Analysis

LF-3C

FACTORS OPTIONS	1	2	3
Biology (cont'd)			
° fish and wildlife features of significance (constraint level)	-	-	-
° rare species (constraint level)	-	-	animal-extreme south edge of study zone
Surface Drainage			
° number of stream crossings	1	0	0
° number of floodplains, floodprone areas and wetlands	0	0	0
Socio-Economic/Land Use			
° number of residences	0	0	6 (250 m)
° number and type - commercial and industrial uses	0	0	1 - automotive transmission (250 m)
° displacement of community and recreation features	0	0	0
° disruption of operations of community and recreation features	0	0	Elcho United Church & Cemetery

TABLE D.3

Phase 4A - Rail Access Options - Comparative Analysis

LF-3C

FACTORS OPTIONS	1	2	3
Socio-Economic/Land Use (cont'd)			
° displacement of residents	0	0	0
° disruption of day-to-day activities and/or the use and enjoyment of property[1]	0	0	7 (170 m) 18 (250 m)
Agriculture			
° proximity to farm buildings (number of building complexes)	0	0	2
° amount of cropland affected (500 m) (ha)	13	15	5
° severance of farm parcels (number and severity)	high	0	moderate
° loss of farmland (Class 1 equivalents) (ha)	.16	.24	.24
Engineering			
° site size	° facility oriented on E-W axis	° facility oriented on E-W axis	° facility oriented on N-S axis

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[1] The figures given for 250 m include the residents within the 170 m impact zone.

TABLE D.3

Phase 4A - Rail Access Options - Comparative Analysis

LF-3C

FACTORS OPTIONS	1	2	3
Engineering (cont'd)			
° landfill life	° least interference with landfill development	° least interference with landfill development	° interferes with landfill development
° off-site facilities	° shortest rail spur required	° shortest rail spur required	° long rail spur required and has to cross a floodplain
° off-site land acquisition required (ha)	0.6	0.55	
° cost of rail infrastructure from mainline to site facility ($ million) (spur line length)	0.919 (1120 m)	0.893 (1080 m)	

TABLE D.3

Phase 4A - Rail Access Options - Comparative Analysis

LF-9C

FACTORS OPTIONS	1	2	3	4	5
Transportation					
° crossing of provincial highways, regional roads and local roads (conflict index; where applicable only)	3 local roads (1.00)			1 local road, 1 provincial highway (5.57)	1 local road, 1 provincial highway (5.57)
° intersection/rail crossing separation distance (m)	>240	<180	<180	180-240	>240
Hydrogeology					
° distance through hydrogeologically sensitive lands (m)	0	0	80	0	0

TABLE D.3

Phase 4A - Rail Access Options - Comparative Analysis

LF-9C

FACTORS OPTIONS	1	2	3	4	5
Biology					
° SEUs (constraint level)	° bisects top part of SEU 18-8 (Davison's Bush) (H)	-	° bisects southern edge of SEU 18-8 (Davison's Bush) (H) ° bisects southern one-third of SEU 18-9 (Comfort's Bush) (H)	° passes through extreme eastern edge of SEU 18-4 (Silverdale Woodlot) (M) ° separated from main SEU	° passes through extreme eastern edge of SEU 18-4 (Silverdale Woodlot) (M) ° this unit is already separated from the more extensive forest to the west by a road and clearings
° non-SEU woodlots greater than 20 ha (constraint level)	-	-	-	° cuts off small part of woodlot (M)	° cuts through western edge of 20 ha woodlot (M)

TABLE D.3

Phase 4A - Rail Access Options - Comparative Analysis

LF-9C

FACTORS OPTIONS	1	2	3	4	5
Biology (cont'd)					
° fish and wildlife features of significance (constraint level)	° crosses Sucker Creek - pike spawning (M)	° crosses Sucker Creek - pike spawning (M)	° crosses Sucker Creek - pike spawning (M)	-	-
° rare species (constraint level)	-	-	-	-	-
Surface Drainage					
° number of stream crossings	4	2	3	2	3
° number of floodplains, floodprone areas and wetlands	6	2	1	4	4
Socio-Economic/Land Use					
° number of residences	4 (170 m) 1 (250 m)	6 (170 m) 4 (250 m)	9 (170 m) 4 (250 m)	1 (250 m)	1 (170 m)
° number and type - commercial and industrial uses	0	1 vacant commercial (170 m)	2 - pool retailing, vacant commercial (170 m)	1 sausage retailing (250 m)	0

TABLE D.3

Phase 4A - Rail Access Options - Comparative Analysis

LF-9C

FACTORS OPTIONS	1	2	3	4	5
Socio-Economic/Land Use (cont'd)					
° displacement of community and recreation features	0	0	° possible historic building	0	0
° disruption of operations of community and recreation features	0	0	° Brethren in Christ Church	0	0
° displacement of residents	0	4	0	0	0
° disruption of day-to-day activities and/or the use and enjoyment of property[1]	14 (170 m) 18 (250 m)	11 (170 m) 32 (250 m)	32 (170 m) 35 (250 m)	4 (250 m)	7 (170 m) 11 (250 m)
Agriculture					
° proximity to farm buildings (number of building complexes)	1	5	6	1	1
° amount of cropland affected (500 m) (ha)	243	245	265	129	98
° severance of farm parcels (number and severity)	low	high	high	low	low

[1] The figures given for 250 m include the residents within the 170 m impact zone.

TABLE D.3

Phase 4A - Rail Access Options - Comparative Analysis

LF-9C

FACTORS OPTIONS	1	2	3	4	5
Agriculture (cont'd)					
° loss of farmland (Class 1 equivalents) (ha)	3.0	2.5	3.3	1.5	1.4
Engineering					
° site size	° facility oriented on N-S axis	° facility oriented on N-S axis	° facility oriented on N-S axis	° facility oriented on N-S axis	° facility oriented on N-S axis
° landfill life	° least interference with landfill development	° interferes with landfill development	° interferes with landfill development	° minimal interference with landfill development	° minimal interference with landfill development
° off-site facilities	° long rail spur required	° long rail spur required	° longest rail spur required	° short rail spur required	° shortest rail spur required
° off-site land acquisition required (ha)	5.78			3.70	3.52
° cost of rail infrastructure from mainline to site facility ($ million) (spur line length)	3.002 (4140 m)			2.129 (2890 m)	2.103 (2850 m)

TABLE D.3

Phase 4A - Rail Access Options - Comparative Analysis

LF-1E

FACTORS OPTIONS	1	2	3	4
Transportation				
° crossing of provincial highways, regional roads and local roads (conflict index)	0		0	N/A
° intersection/rail crossing separation distance (m)	N/A	<180	N/A	N/A
Hydrogeology				
° distance through hydrogeologically sensitive lands (m)	N/A	0	0	N/A
Biology				
° SEUs (constraint level)	N/A	° skirts E. edge of part of SEU 19-2 (Horse Track Woodlot) (L)	-	N/A
° non-SEU woodlots greater than 20 ha (constraint level)	N/A	-	-	N/A

TABLE D.3

Phase 4A - Rail Access Options - Comparative Analysis

LF-1E

FACTORS OPTIONS	1	2	3	4
Biology (cont'd)				
° fish and wildlife features of significance (constraint level)	N/A	-	-	N/A
° rare species (constraint level)	N/A	-	-	N/A
Surface Drainage				
° number of stream crossings	N/A	1	0	N/A
° number of floodplains, floodprone areas and wetlands	N/A	1	0	N/A
Socio-Economic/Land Use				
° number of residences	N/A	1 (250 m)	0	N/A
° number and type of commercial and industrial uses	N/A	0	0	N/A
° displacement of community and recreation features	N/A	0	0	N/A

TABLE D.3

Phase 4A - Rail Access Options - Comparative Analysis

LF-1E

FACTORS OPTIONS	1	2	3	4
Socio-Economic/Land Use (cont'd)				
° disruption of operations of community and recreation features	N/A	0	0	N/A
° displacement of residents	N/A	0	0	N/A
° disruption of day-to-day activities and/or the use and enjoyment of property[1]	N/A	3 (170 m) 3 (250 m)	0	N/A
Agriculture				
° proximity to farm buildings (number of building complexes)	N/A	0	1	N/A
° amount of cropland affected (500 m)	N/A	65	31	N/A
° severance of farm parcels (number and severity)	N/A	low	0	N/A
° loss of farmland (Class 1 equivalents) (ha)	N/A	.7	.8	N/A

[1] The figures given for 250 m include the residents within the 170 m impact zone.

TABLE D.3

Phase 4A - Rail Access Options - Comparative Analysis

LF-1E

FACTORS OPTIONS	1	2	3	4
Engineering				
° site size	° facility oriented on E-W axis	° facility oriented on E-W axis	N/A	N/A
° landfill life	° least interference with landfill development	° interferes with landfill development	N/A	N/A
° off-site facilities	° shortest rail spur required	° long rail spur required	N/A	N/A
° off-site land acquisition required (ha)	0.18		0.18	N/A
° cost of rail infrastructure from mainline to site facility ($ million) (spur line length)	0.677 (840 m)		0.697 (870 m)	N/A

TABLE D.4

Rail Access

Factors Used in Comparative Evaluation of Options

FACTOR GROUPING	FACTOR	RATIONALE FOR FACTORS
A. **RISK**		
° Transportation	° number and type of roads crossed (local, regional, provincial highways)	° transportation safety along roadways near the candidate site may be affected by the introduction of level railway crossings ° crossing of an access road has greater risks than non-access roads ° crossing of provincial highways has even greater importance
	° intersection/rail crossing separation distance (m)	° Ontario MTC requires that for roadways where the posted speed is 80 km/hr. that adequate warning distance for level railway crossing is 180 to 240 m ° it is necessary to separate a roadway intersection and rail crossing by this distance in order that vehicles turning on to the road will have adequate sight and stopping distance prior to encountering the crossing
° Hydrogeology	° distance through hydrogeologically sensitive lands	° in the event of a spill it is desirable that the natural materials retard the migration of contaminants from the spill through the subsurface

TABLE D.4

Rail Access

Factors Used in Comparative Evaluation of Options

FACTOR GROUPING	FACTOR	RATIONALE FOR FACTORS
A. **RISK** (cont'd)		
° Hydrogeology		° retardation provides sufficient lead time to implement remedial actions ° lands not likely to provide a high degree of natural containment are defined as sensitive
° Surface Water Suitability	° number of stream crossings	° watercourses could provide pathway for rapid movement of reagents in the event of a spill
	° number of floodplains, flood-prone areas and wetlands	° this information used to estimate the potential for flooding associated with a rail access option ° no rail access option should be located on floodplains or flood-prone lands
B. **ENVIRONMENTAL IMPACTS**		
° Residents	° displacement of residents	° construction of rail line could result in the displacement of residents ° factor designed to reflect potential hardships which would be experienced by displaced residents

TABLE D.4

Rail Access

Factors Used in Comparative Evaluation of Options

FACTOR GROUPING	FACTOR	RATIONALE FOR FACTORS
B. **ENVIRONMENTAL IMPACTS** (cont'd)		
° Residents	° disruption of day-to-day activities and/or the use and enjoyment of property	° anticipated that use of a rail line would disrupt the activities and property uses of residents in the vicinity ° factor reflects the potential disruption that would be experienced by residents in the vicinity of the rail line
° Community and Recreation Features	° displacement of community and recreation features	° construction of a rail line could result in the displacement of community and recreation features ° factors reflects the potential hardships experienced by the clients and community due to displacement of such features
	° disruption of operations of community and recreation features	° anticipated that the use of a rail line would disrupt the operations of community and recreation features in the vicinity of rail line ° factor designed to reflect potential disruptions that features in the vicinity of the rail line might experience

TABLE D.4

Rail Access

Factors Used in Comparative Evaluation of Options

FACTOR GROUPING	FACTOR	RATIONALE FOR FACTORS
B. ENVIRONMENTAL IMPACTS (cont'd)		
° Land Use	° number of residences[1]	° residential land uses incompatible with OWMC facility and/or rail line
	° number and type of commercial facilities	° provides an indication of impact on commercial uses and relative compatibility with OWMC facilities
° Agricultural Resources	° proximity to farm buildings (number of building complexes)	° active farm buildings used to indicate viable farm operations and the potential for disruption to livestock ° indicates the direct impacts to farming ° noise and risk of accident could interfere with farm activities
	° severance of farm parcels (number and severity)	° severances may create small fields which are inefficient to operate and have difficult farm machinery access to fields

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[1] Information provided to IER by the land use consultant, Leon Kentridge Associates Ltd. Only the information pertaining to "residents" was employed in the comparative evaluation. To employ both "residents" and "residences" counts would represent double counting.

TABLE D.4

Rail Access

Factors Used in Comparative Evaluation of Options

FACTOR GROUPING	FACTOR	RATIONALE FOR FACTORS
B. **ENVIRONMENTAL IMPACTS** (cont'd)		
° Agricultural Resources	° amount of cropland affected (500 m ha)	° indicator of the relative risk to standing crops due to rail accidents and for spills of materials while in transit
	° loss of farmland (Class 1 equivalents) (ha)	° construction of rail line would result in the direct transfer of land available for agricultural production to non-agricultural uses
° Natural Environment	° rare species	° number of rare species is an indication of the environmental significance of a geographic unit ° assumed that the more rare species encountered, the higher the probability of creating an environmental impact
	° fish and wildlife features of significance	° in the interests of avoiding impacts on the natural environment, significant biological features were identified ° natural features of significance may be eliminated or fragmented by construction of rail line

TABLE D.4

Rail Access

Factors Used in Comparative Evaluation of Options

FACTOR GROUPING	FACTOR	RATIONALE FOR FACTORS
B. **ENVIRONMENTAL IMPACTS** (cont'd)		
° Natural Environment	° significant environmental units (SEUs)	° areas may perform significant environmental functions or contain significant environmental features
	° non-SEU woodlots greater than 20 ha	° documents the presence of a vegetation unit which may have value as a forestry or recreational resource or may provide wildlife habitat
		° flags areas with potential for significance
C. **ENGINEERING COST**	° site size	° necessary to ensure that provision of rail service will not interfere with efficient operation of facility
		° need to ensure that storage of rail cars on-site possible
		° need to ensure that rail line provides optimal access to physical/chemical treatment plant
	° landfill life	° desirable to minimize interference with landfill development, to the extent possible

TABLE D.4

Rail Access

Factors Used in Comparative Evaluation of Options

FACTOR GROUPING	FACTOR	RATIONALE FOR FACTORS
C. **ENGINEERING COST** (cont'd)	° off-site facilities	° rail access options with shortest rail spur requirement preferred
	° cost of rail infrastructure from mainline to plant	° lowest ranked site selection factor ° rail access option with lowest cost preferable, all other things being equal
	° off-site land acquisition required	° in addition to cost of construction, a right-of-way will need to be purchased to accommodate the rail spur line

TABLE D.5

Summary of Consultants' Ranking of Factors - Comparative Evaluation of Rail Access Options

Consultant	Area of Responsibility	Factors	Ranking of Factors	Rationale for Ranking
M.M. Dillon Ltd.	Transportation	° intersection/rail crossing separation	° high level of importance - 3	° exclusionary factor ° minimum distance set by Ontario M.T.C.
		° number and type of roads crossed	° medium level of importance - 2	° this transport safety concern is mitigable ° cost of rail construction already includes the provision of level rail crossing protection devices in its calculations
Gartner Lee Associates Ltd.	Surface Water Suitability	° number of stream crossings	° factors considered equal in importance	
		° number of floodplains, flood-prone areas and wetlands		
Gartner Lee Associates Ltd.	Biology	° significant environmental units (SEUs)	° factors considered equal in importance	

TABLE D.5

Summary of Consultants' Ranking of Factors – Comparative Evaluation of Rail Access Options

Consultant	Area of Responsibility	Factors	Ranking of Factors	Rationale for Ranking
Gartner Lee Associates Ltd.	Biology	° non-SEU woodlots greater than 20 ha ° fish and wildlife features of significance ° rare species		
Institute of Environmental Research Inc.	Social Analysis	° displacement of residents ° disruption of day-to-day activities and/or the use and enjoyment of property - 170 m - 250 m	high priority ↑	° research indicates that disruption experienced by residents displaced greater than disruption created for residents left behind ° displacement of community and recreation features is judged to be less important than displacement or disruption of residents

TABLE D.5

Summary of Consultants' Ranking of Factors – Comparative Evaluation of Rail Access Options

Consultant	Area of Responsibility	Factors	Ranking of Factors	Rationale for Ranking
Institute of Environmental Research Inc.	Social Analysis	° displacement of community and recreation features	↓	° residents and community and recreation features with 170 m impact zone given higher priority than those within 250 m impact zone; potential nuisance and noise impacts greater within 170 m
		° disruption of operations of community and recreation features	low priority	
Leon Kentridge Associates Ltd.	Land Use	° number of residences	1	° residential uses considered to be most sensitive to noise and disruptive impacts
		° number and type of commercial facilities	2	° potentially sensitive to noise and disruption, but not considered as sensitive as residential uses
Ecologistics Ltd.	Agricultural Resources	° loss of farmland	° weight – 3	° a direct transfer of land to non-agricultural uses ° cannot be recovered

TABLE D.5

Summary of Consultants' Ranking of Factors – Comparative Evaluation of Rail Access Options

Consultant	Area of Responsibility	Factors	Ranking of Factors	Rationale for Ranking
Ecologistics Ltd.	Agricultural Resources	° severance of farm parcels	° weight – 3	° an on-going disruption to farm activities ° potential creation of small fields which are inefficient to operate, and difficult access to fields
		° proximity to farm buildings	° weight – 2	° potential risk to farm people, livestock and structures which are adjacent to the railroad
		° amount of cropland affected	° weight – 1	° a relatively short-term impact to standing crops ° can be more readily compensated for loss or impact than for other factors
Monenco Ltd.	Engineering	° site size	° low	° low level of relative constraint
		° landfill life	° low	° low level of relative constraint
		° off-site facilities	° low	° low level of relative constraint
		° cost of rail infra-structure construction	° medium level of importance – 2	° costs reflect distance between site and main line; includes costs for mitigating conflicts with road users of new level railway crossings ° cost is lowest ranked OWMC goal

TABLE D.5

Summary of Consultants' Ranking of Factors – Comparative Evaluation of Rail Access Options

Consultant	Area of Responsibility	Factors	Ranking of Factors	Rationale for Ranking
Monenco Ltd.	Engineering	° off-site land acquisition required	° low level of importance - 1	° this component of cost will not be as high as the cost of railway infrastructure ° cost is lowest ranked OWMC goal

TABLE D.6

Rail Access

Comparison of Constraint Mapping and Comparative Evaluation Factors

Factor Grouping	Constraint Mapping Factor	Comparative Evaluation of Options Factor	Comments
A. **RISK**			
o **Transportation**	o range limitations for service	-	o used to define limits for constraint mapping exercise only
	o road crossings (for LF-2N and PI-13N)	o number and type roads crossed (local, regional, provincial highways)	o crossings examined for all options o possible to examine now that specific options identified
	o construction cost (for LF-2N and PI-13N)	o cost of rail infrastructure from mainline to plant	o cost examined for all options
	-	o intersection/rail crossing separation distance (m)	o treated as exclusionary
o **Hydrogeology**	-	o distance through hydrogeologically sensitive lands	o possible to examine now that specific options identified
o **Surface Water Suitability**	o number of stream crossings	o number of stream crossings	

TABLE D.6

Rail Access

Comparison of Constraint Mapping and Comparative Evaluation Factors

Factor Grouping	Constraint Mapping Factor	Comparative Evaluation of Options Factor	Comments
A. RISK (cont'd)			
° Surface Water Suitability	-	° number of floodplains, flood-prone areas and wetlands	° increased level of detail for comparative evaluation of options
B. ENVIRONMENTAL IMPACTS			
° Residents	° estimated population	° displacement of residents	° finer breakdown of factor ° possible to determine number of residents, displaced now that specific options identified
		° disruption of day-to-day activities and/or the use and enjoyment of property	° increased level of detail for comparative evaluation of options
° Community and Recreation Features	° community and recreation features	° displacement of community and recreation features	° finer breakdown of factor
		° disruption of operation of community and recreation features	° increased level of detail for comparative evaluation of options

TABLE D.6

Rail Access

Comparison of Constraint Mapping and Comparative Evaluation Factors

Factor Grouping	Constraint Mapping Factor	Comparative Evaluation of Options Factor	Comments
B. **ENVIRONMENTAL IMPACTS** (cont'd)			
° Land Use	° existing residences and clusters of residences	° number of residences	
	° existing commercial and industrial facilities	° number and type of commercial facilities	° no industrial facilities present
	° residential land use designations	-	° residential land use designations excluded in constraint mapping
° Agricultural Resources	° proximity to farm buildings	° proximity to farm buildings (number of farm complexes) (within 500 m zone)	
	° severance of farm parcels	° severance of farm parcels (number and severity)	

TABLE D.6

Rail Access

Comparison of Constraint Mapping and Comparative Evaluation Factors

Factor Grouping	Constraint Mapping Factor	Comparative Evaluation of Options Factor	Comments
B. **ENVIRONMENTAL IMPACTS** (cont'd)			
° Agricultural Resources	° cropland	° amount of cropland affected (within 500 m zone) (ha)	° possible to calculate actual area of cropland now that specific options identified
	–	° loss of farmland (Class 1 equivalents) (within 18.3 m band)	° increased level of detail for comparative evaluation of options ° possible to calculate land lost now that specific options identified
° Natural Environment	° SEUs	° SEUs	
	° non-SEU woodlots greater than 20 ha	° non-SEU woodlots greater than 20 ha	
	–	° rare species	° increased level of detail for comparative evaluation of options
	–	° fish and wildlife features of significance	° increased level of detail for comparative evaluation of options

TABLE D.6

Rail Access

Comparison of Constraint Mapping and Comparative Evaluation Factors

Factor Grouping	Constraint Mapping Factor	Comparative Evaluation of Options Factor	Comments
C. **ENGINEERING COST**	–	° site size	° increased level of detail for comparative evaluation of options
	–	° landfill life	° increased level of detail for comparative evaluation of options
		° off-site facilities	° increased level of detail for comparative evaluation of options
	–	° off-site land acquisition required	° possible to examine now that specific options identified

APPENDIX E

(APPENDIX TO CHAPTER 7)

APPENDIX E

INTRODUCTION

In Phase 4A, a number of study areas were defined along the local and regional access system. An 800 m. study area was used to examine potential impacts resulting from an accident involving tank trailers carrying a flammable solvent. The rationale for this study area is provided in Appendix C.

In addition, two risk bands of 150 m. and 500 m. were defined by the risk consultant, Environ Corporation. This appendix provides the rationale for these two risk zones.

DEFINITION OF TRANSPORTATION CORRIDOR

INTRODUCTION

In the comparison of candidate sites for the OWMC facility, one of the site selection factors considered was the population density along the local access route. To compare sites on this basis it was first necessary to define a zone of significant influence in the event of a spill of special wastes occurring on the local access route. The purpose of this analysis, therefore, is to provide a rationale based on human health risk for defining the "zone of significant influence" for site selection purposes.

APPROACH

The methodology for defining the "zone of significant influence" draws upon the approach used in the comparison of risk pathways. The scenario considered is a spill of special wastes with subsequent volatilization and dispersion towards an adjacent residence. As in the comparison of risk pathways, a methylene chloride waste stream was selected as presenting the most significant risk as a result of exposure via the air pathway. Thereafter, there are significant differences in the methodology for defining the transportation corridor relative to that used in the comparison of risk pathways. For comparing risk pathways a series of conservative assumptions were used to characterize risk: ambient temperatures conditions of 25°C, atmospheric stability class F, and a health endpoint defined by a no effect level. Applying these assumptions to selecting a zone of influence would result in a relatively wide transportation corridor.

A more appropriate scheme for defining a "zone of significant influence" might be to consider a "typical" set of weather conditions. At this time an analysis of the frequency of different atmospheric stability classes and temperature combinations is being undertaken by Ontario Research Foundation, and will provide the basis for identifying the most typical conditions. In the meantime the preliminary analysis presented here addresses four sets of atmospheric stability/temperature combinations as follows:

1. Stability Class D, 10°C
2. Stability Class D, 25°C
3. Stability Class F, 10°C
4. Stability Class F, 25°C

Scenario 1, Stability Class D and 10°C, is generally thought to represent "typical" weather conditions in southern Ontario.

METHODOLOGY

In order to define the zone of significant influence, the acute safe exposure level (ASEL) was used. The ASEL is derived from the no-observed-effect level (NOEL) by applying both a safety factor and a severity factor. The distance defined by equivalent to the ASEL would define the outer band of the zone. It was recognized that a health endpoint based on an ASEL was a very conservative assumption and that at distances closer to the source, levels existed at which there would be minor, nonincapacitating, reversible effects in the exposed population. As an approximation, the level associated with a dose one-tenth of the ASEL was chosen to represent the inner band of the zone of significant influence.

An acute safe exposure level (ASEL) of 0.5 mg/kg was developed for methylene chloride.[1] A corresponding safe concentration level for approximately one hour can readily be calculated from the following equation:

$$X = \frac{(D)\ (BW)}{(BR)(AF)(t)(1000)} \qquad (1)$$

where X = conc. in air, g/m^3

D = dose received, mg/kg

BR = breathing rate, m^3/h

AF = absorption factor, dimensionless

t = exposure time = h

BW = body weight = kg

Using a Gaussian plume model for a ground level source this concentration can be related to the emission rate (see p. 79 of the Generic Risk Assessment) by:

$$X = \frac{Q}{(\pi)(\sigma_y)(\sigma_z)(u)} \qquad (2)$$

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[1] The ASEL of 0.5 mg/kg is based on a safety factor of 10 (to account for intraspecies variability) and a severity factor of 10 (to estimate a NOEL from a lowest-observed-adverse-effect level). Further analysis and review of the data indicate that a severity index of 2 may be more appropriate given the relatively minor effects observed.

where X = concentration in the air, g/m^3

Q = emission rate, g/s

σ_y = dispersion coefficient in the lateral direction, m

σ_z = dispersion coefficient in the vertical direction, m

u = wind speed, m/s

Rearranging this equation,

$$\sigma_y \sigma_z = \frac{Q}{(\pi)(X)(u)} \tag{3}$$

where the emission rate, Q is defined by:

$$Q = \frac{(Kg)(A)(P)(M)}{(R)(T)} \tag{4}$$

where Kg = the gas mass transfer coefficient, m/s

A = area of spill, m^2

P = vapor pressure, Pa

M = molecular weight, g/mol

R = gas constant, Pa m^3/mol K

T = temperature, K

Based on Figures 3-2 and 3-3 (Pasquill-Gifford curves) in Turner's Workbook of Atmospheric Dispersion Estimates (Turner, 1970), relationships between σ_y and σ_z were derived for stability classes D and F as follows:

D Stability -- $\sigma_y = 1.77\ \sigma_z$ (5)

F Stability -- $\sigma_y = 2.36\ \sigma_z$ (6)

For a given stability class the dispersion coefficients are function of downwind distance. Equations that approximately fit the Pasquill-Gifford curves are normally used to calculate σ_y and σ_z. The equation used to calculate σ_z is of the form

$$\sigma_z = ax^b \tag{7}$$

where x = downwind distance

a,b = coefficients based on downwind distance and stability class

This equation is considered appropriate for downwind distances of approximately 100 m and greater.

The dispersion coefficients above apply to point source releases. A correction is usually applied to area sources, such as a pool of liquid, to account for the lateral dimension of the source. However, at the downwind distances considered in this scenario and the relatively small lateral pool dimension (7m), the source can be modeled as a point emission.

To calculate the zone of influence, equation 3 was used with equations 5 and 6 to solve for σ_z. Equation 7 was then used to calculate the zone of influence, x.

RESULTS

Using the four sets of weather conditions and the health endpoints described above, the zone of influence is characterized below:

TRANSPORTATION "ZONES OF INFLUENCE"

Stability Class	Temperature	ASEL (m)	0.1(ASEL) (m)
D	10°C	506	130
D	25°C	737	185
F	10°C	1605	307
F	25°C	2500	452

For Stability Class D and temperature equal to 10°C, the typical conditions in Southern Ontario, the zone of influence would be approximately 150 to 500 meters. By assuming more severe atmospheric conditions, the zone of significant influence would be expanded. However, given the low probability of the event occurring in combination with the most severe atmospheric conditions, the zone of significant influence under typical atmospheric conditions was determined to be appropriate.

APPENDIX F

(APPENDIX TO CHAPTER 7)

APPENDIX F

INTRODUCTION

Appendix F consists of the following tables:

- Table F.1 - Rationale for Factors Used in Selection of the Location for the Physical/Chemical Treatment Plant
- Table F.2 - Ranking of Transportation Risk Indicators
- Table F.3 - Consultants' Risk Factor Rankings Used in Selection of the Physical/Chemical Treatment Plant Location
- Table F.4 - Consultants' Impact Factor Rankings Used in Selection of the Physical/Chemical Treatment Plant Location
- Table F.5 - Location of Physical/Chemical Treatment Plant - Step 2 - Systematic Review of Rankings for Alternatives by Factor - Siting Option -- LF-1E/PI-27E
- Table F.6 - Location of Physical/Chemical Treatment Plant - Step 2 - Systematic Review of Rankings for Alternatives by Factor - Siting Option - LF-4N/PI-13N
- Table F.7 - Location of Physical/Chemical Treatment Plant - Step 2 - Systematic Review of Rankings for Alternatives by Factor - Siting Option - LF-4N/PI-1N

Table F.1 lists the factors used in the selection of the location of the physical/chemical treatment plant and provides a rationale for each factor.

Table F.2 provides a ranking of transportation risk indicators as well as a rationale for the ranking.

Tables F.3 and F.4 provide the consultants' rankings used in the selection of the physical/chemical treatment plant location for risks and impacts, respectively.

Tables F.5, F.6 and F.7 indicate the factor rank, preference, and magnitude of difference between Cases 2 and 3 for siting options LF-1E/PI-27E, LF-4N/PI-13N and LF-4N/PI-1N.

TABLE F.1

RATIONALE FOR FACTORS USED IN SELECTION OF THE LOCATION FOR THE PHYSICAL/CHEMICAL TREATMENT PLANT

Factor Grouping	Factor	Rationale
A. RISK		
Transportation	° Transportation Risk due to Spills: Risk to human and environmental receptors along local and regional access roads due to the hazard based spill index for the transport of special wastes, additives and reagents, and inter-site transfers	° The options involve different numbers and types of vehicles travelling to and among the component sites ° This factor combines receptors and spill risk data to provide a measure of change in risk to people depending on the location of the physical/chemical treatment plant
	° Transportation Risk due to Accident Involvement: Risk to road users on local and regional access roads due to the involvement in accidents by trucks carrying special wastes, additives and reagents, and inter-site transfers	° As above for spills, this factor measures risk to road users depending on the probability of accidents associated with the alternative physical/ chemical treatment plant locations
Hydrogeology	° Capability to provide natural containment	° The introduction of additional potential contaminants associated with the physical/chemical treatment plant could affect capability to provide natural containment and associated risk to human health
Air Quality	° Risks from direct inhalation of emissions-chronic	° Chronic fugitive emissions from the physical/chemical treatment plant were assessed with regard to

TABLE F.1

RATIONALE FOR FACTORS USED IN SELECTION OF THE LOCATION FOR THE PHYSICAL/CHEMICAL TREATMENT PLANT

Factor Grouping	Factor	Rationale
A. RISK		
Air Quality (Continued)		potential risk to human health
	° Risks for direct inhalation of emissions - acute	° The physical/chemical treatment plant produces acute, low elevation emissions which were assessed with regard to potential risk to human health
	° Risks from ingestion of cistern and pond water	° Fugitive emissions could contaminate cistern and pond water causing a potential risk to human health
	° Risks from consumption of crops and livestock	° Fugitive emissions could contaminate crops and livestock causing a potential risk to human health

TABLE F.1

RATIONALE FOR FACTORS USED IN SELECTION OF THE LOCATION FOR THE PHYSICAL/CHEMICAL TREATMENT PLANT

Study Area	Factor Grouping	Factor	Rationale
B. IMPACT			
Site	Land Use	° Proposed and planned land use	° Displacement of planned land uses can affect off-site residents and communities
	Natural Environment	° Displacement of natural features	° Placement of the physical/chemical treatment plant with the incinerator allows greater flexibility to avoid natural features on the landfill site
Site Vicinity	Residents	° Disruption of day-to-day activities and/or use and enjoyment of properties	° The Case 2 and Case 3 facility combinations would produce different sound levels in the vicinity of the sites
	Land Use	° Existing land use	° The physical/chemical treatment plant is industrial in nature and could have impacts other than noise on the surrounding residences and commercial features (e.g. visual, nuisance)
		° Planned and proposed land use	° The development of future planned land uses may be disrupted by the location of the physical/chemical treatment plant

TABLE F.1

RATIONALE FOR FACTORS USED IN SELECTION OF THE LOCATION FOR THE PHYSICAL/CHEMICAL TREATMENT PLANT

Study Area	Factor Grouping	Factor	Rationale
B. IMPACT			
Site Vicinity (Continued)	Agricultural Resources	° Disruption of existing farm operations	° This factor provides a relative measure of the operators who could be directly or indirectly affected by each siting combination
		° Agricultural community impacts	° The potential effects on agriculture of introducing industrial uses, such as the physical/chemical treatment plant, into a stable agricultural area, will tend to be greater than in areas where there are numerous non-agricultural activities ° This factor measures stability of the agricultural community
	Air Quality	° Restraints to dispersion	° Dispersion of fugitive emissions from the treatment plant could be affected by local restraints to dispersion
		° Existing and anticipated air quality	° Fugitive emissions can affect existing and anticipated air quality
Access Roads	Residents	° Disruption of day-to-day activities and/or use and enjoyment of properties	° Additional truck traffic associated with the treatment plant could reduce accessibility and cause dust, noise, vibration and nuisance effects

TABLE F.1

RATIONALE FOR FACTORS USED IN SELECTION OF THE LOCATION FOR THE PHYSICAL/CHEMICAL TREATMENT PLANT

Study Area	Factor Grouping	Factor	Rationale
B. IMPACT			
Access Roads	Community and Recreation Features	° Disruption of operations of community and recreation features	° Additional truck traffic associated with the treatment plant could reduce accessibility and cause noise, dust, vibration and nuisance impacts
	Land Use	° Transportation impact index	° This factor combines residences and commercial use and truck traffic volume data to provide a measure of the change in impacts associated with the Case 2 and Case 3 options
	Agricultural Resources	° Disruption of existing farm operations	° Change in the number of vehicles along access routes may have direct effect on farming activities and interference with farm traffic
	Natural Environment	° Disruption of fish communities	° Change in number of vehicles and potential of spills affects the potential for impacts on fish communities in watercourses crossing access routes
	Cost	° Capital costs	° Capital costs are affected by placement of the treatment plant

TABLE F.1

RATIONALE FOR FACTORS USED IN SELECTION OF THE LOCATION FOR THE PHYSICAL/CHEMICAL TREATMENT PLANT

Study Area	Factor Grouping	Factor	Rationale
B. IMPACT			
Access Roads (Continued)			° Duplication of some facilities is required when the treatment plant and incinerator are separated
C. ENGINEERING		° Operating costs	° Service facilities are duplicated when the incinerator and treatment plant are separated
		° Site area	° Landfill life is reduced when the treatment plant is located with the landfill reducing the area available for landfill calls

Table F.2

RANKING OF TRANSPORTATION RISK INDICATORS

FACTOR/INDICATOR	INDICATOR RANK/WEIGHT	RATIONALE
o Risks due to spills[1]		
° risks to population due to spills	5	° Frequency of exposure to spills greater than for road users ° Direct pathway to humans ° Margin of safety is less than one (measurable health effects) for human receptors at location 20 m from spill ° Mitigation cannot be assumed
° risks to road users due to spills	4	° Duration of exposure to spills not potentially as high as for permanent population along access roads ° Direct pathway to humans ° Margin of safety less than one (measurable health effects) for human receptors at location 20 m from spill ° Mitigation cannot be assumed
° risk of entry into surface water due to spill	2	° Potential for spill into surface water and ingestion of surface water is lower than for direct pathway ° Potential for mitigation is high ° Potentially severe effects possible
o Risks due to accident involvements		
° risks to road users due to accidents	none	° No indicator weight was required because only one indicator was used

[1] Note indicator for risk to sensitive community and recreation features screened from analysis because no features were found.

TABLE F.3

CONSULTANT'S RISK FACTOR RANKINGS USED IN SELECTION OF THE PHYSICAL/CHEMICAL TREATMENT PLANT LOCATION

Factor Grouping	Factor	Factor Rank	Rationale
A. RISK			
Transportation	° Transportation Risk due to Spills: Risk to human and environmental receptors along local and regional access roads due to the hazard based spill index for the transport of special wastes, additives and reagents, and inter-site transfers	10	Both transportation events can effect human health, the differences in probability of occurrences and numbers affected is accounted for in the indicator values
	° Transportation Risk due to Accident Involvement: Risk to road users on local and regional access roads due to the involvement in accidents by trucks carrying special wastes, additives and reagents, and inter-site transfers	10	° See above
Hydrogeology	° Capability to provide natural containment		° Screened from analysis therefore no ranking applied
Air Quality	° Risks from Direct Inhalation of Emissions - Acute	Most Important	° Mixing of incompatible wastes during treatment could result in the release of a significant quantity of toxic vapours
	° Risks from Direct Inhalation of Emissions - Chronic	Less Important than Acute	° Relatively small routine or chronic emissions from the physical/chemical treatment plant

TABLE F.3

CONSULTANT'S RISK FACTOR RANKINGS USED IN SELECTION OF THE PHYSICAL/CHEMICAL TREATMENT PLANT LOCATION

Factor Grouping	Factor	Factor Rank	Rationale
A. RISK			
Air Quality (Continued)	° Risks from Ingestion of Cistern and Pond Water	Less Important	° Indirect pathways have less magnitude of risk and potential for mitigation than for acute or chronic direct pathways
	° Risks from Consumption of Crops and Livestock	Less Important	° See above

TABLE F.4

CONSULTANT'S IMPACT FACTOR RANKINGS USED IN SELECTION OF THE PHYSICAL/CHEMICAL TREATMENT PLANT LOCATION

Study Area	Factor Grouping	Factor	Factor Rank	Rationale
Site Vicinity	Residents	° Disruption of day-to-day activities and/or the use and enjoyment of property	High Priority	° Impacts on residents are direct and mitigation is limited
Access Roads	Residents	° Disruption of day-to-day activities and/or the use and enjoyment of property	High Priority	° See above
Access Roads	Community and Recreation Features	° Disruption of operations of community and recreation features	Moderate - Low Priority	° Impacts on community and recreation features expected to be minor and indirect; some mitigation possible
Site Vicinity	Land Use	° Existing land Use	1	° Residences are most sensitive existing land use - preference to locating physical/chemical plant near fewest residences ° Commercial facilities are considered less sensitive than residential uses, but potential for adverse impacts
Site	Land Use	° Land Use Designations	2	° Key land use consideration is compatibility of physical/chemical treatment plant with industrial

TABLE F.4

CONSULTANT'S IMPACT FACTOR RANKINGS USED IN SELECTION OF THE PHYSICAL/CHEMICAL TREATMENT PLANT LOCATION

Study Area	Factor Grouping	Factor	Factor Rank	Rationale
Site (Cont'd)				designations and incompatibility with residential and agricultural designations
Site Vicinity	Land Use	° Land Use Designations	3	° Compatibility of OWMC facilities with surrounding land use designations also an important consideration
Access Roads	Land Use	° Transportation Impact Index	4	° Impacts along access roads due to increased truck traffic considered less critical than facility impacts on land uses near industrial facility components
Site Vicinity	Agricultural Resources	° Disruption of Existing Farm Operations ° Agricultural Community Impacts	Equal	° All agricultural factors ranked equally because the differences in importance were considered minimal in assessing the overall impact on the agricultural community in the vicinity of the sites and along access roads

TABLE F.4

CONSULTANT'S IMPACT FACTOR RANKINGS USED IN SELECTION OF THE PHYSICAL/CHEMICAL TREATMENT PLANT LOCATION

Study Area	Factor Grouping	Factor	Factor Rank	Rationale
Access Roads	Agricultural Resources	° Disruption of Existing Farm Operations	Equal	° See above
Site	Natural Environment	° Displacement of Natural Features	No Ranking	° The differences in importance between biology factors were considered minimal ° Both factors favoured Case 2 for all options
Access Roads	Natural Environment	° Disruption of Fish Communities	No Ranking	° See above
Site Vicinity	Air Quality	° Restraints to Dispersion	Considered Less Important than Risk Factors	° Air quality impact are expected to be minor for physical/chemical treatment plant
Site Vicinity	Air Quality	° Existing and Anticipated Air Quality	Considered Less Important than Risk Factors	° Air quality impacts are expected to be minor for physical/chemical treatment plant

TABLE F.5

LOCATION OF PHYSICAL/CHEMICAL TREATMENT PLANT
STEP 2 - SYSTEMATIC REVIEW OF RANKINGS FOR ALTERNATIVES BY FACTOR
SITING OPTION: LF-1E/PI-27E

STUDY AREA	FACTOR GROUPING/ FACTOR	FACTOR RANK	PREFERENCE		MAGNITUDE OF DIFFERENCE BETWEEN CASE 2 AND CASE 3
			CASE 2	CASE 3	
	A. RISK				
	Transportation				
	° Transportation risk due to spills	3	2[1]	1	° Case 2 preferred by all indicators ° largest difference between options with regard to risk to population compared to all options under consideration
	° Transportation risk due to accidents	3	2	1	° preference for Case 2 because there are 30% fewer trucks travelling the 2.7 km between the sites
	° Overall transportation		12[2]	6	° Case 2 preferred for both risks due to spills and accidents; preference reflected in quantitative analysis 12 versus 6
	Hydrogeology				° factor screened
	Air Quality				
	° Risks from direct inhalation of emissions-chronic	1	1	2	° clear preference for Case 3 (LF-1E)

[1] 2 is preferred option; high value indicates greater preference

[2] Overall value is calculated as follows: Factor rank x Preference value
e.g. (3 x 2) + (3 x 2) = 12 for overall transportation Case 2

TABLE F.5

LOCATION OF PHYSICAL/CHEMICAL TREATMENT PLANT
STEP 2 - SYSTEMATIC REVIEW OF RANKINGS FOR ALTERNATIVES BY FACTOR
SITING OPTION: LF-1E/PI-27E

STUDY AREA	FACTOR GROUPING/ FACTOR	FACTOR RANK	PREFERENCE		MAGNITUDE OF DIFFERENCE BETWEEN CASE 2 AND CASE 3
			CASE 2	CASE 3	
	A. RISK				
	Air Quality (cont'd)				
	° Risks from direct inhalation of emissions-acute	2			° no clear preference ° two of four indicators clearly favour Case 2 and one favours Case 3
	° Risks from ingestion of cistern and pond water	1	2	1	° clear preference for PI-27E (Case 2)
	° Risks from consumption of crops and livestock	2	2	1	° marginal preference for PI-27E (Case 2)
	° Overall air quality		5	4	° no clear preference ° preference for Case 3 for chronic emissions and Case 2 for cistern and pond water ingestion; factors are ranked equally, therefore no preference

TABLE F.5

LOCATION OF PHYSICAL/CHEMICAL TREATMENT PLANT
STEP 2 - SYSTEMATIC REVIEW OF RANKINGS FOR ALTERNATIVES BY FACTOR
SITING OPTION: LF-1E/PI-27E

STUDY AREA	FACTOR GROUPING/ FACTOR	FACTOR RANK	PREFERENCE		MAGNITUDE OF DIFFERENCE BETWEEN CASE 2 AND CASE 3
			CASE 2	CASE 3	
	B. IMPACT				
	Residents				
Site Vicinity	° Disruption of day-to-day activities and/or use and enjoyment of properties	3	1	2	° Case 2 has substantially more residents within the site vicinity noise impact zone than Case 3 (244 versus 20)
	° Existing land use (residences)	3	2	1	° substantially fewer residences (38) impacted by industrial facilities in 1000 m zone
Access Roads	° Disruption of day-to-day activities and/or use and enjoyment of properties	3	2	1	° the noise impact on residents along access roads is potentially the same for both cases ° Case 3 has a slightly greater impact index associated with residents adjacent to, and within 800 m of access roads
	° Overall residents		15	12	° no preference with regard to site vicinity impacts on residents; noise impacts prefer Case 3 and all other impacts prefer Case 2; factors ranked equally ° Case 2 marginally preferred for access road impacts

TABLE F.5

LOCATION OF PHYSICAL/CHEMICAL TREATMENT PLANT
STEP 2 - SYSTEMATIC REVIEW OF RANKINGS FOR ALTERNATIVES BY FACTOR
SITING OPTION: LF-1E/PI-27E

STUDY AREA	FACTOR GROUPING/ FACTOR	FACTOR RANK	PREFERENCE		MAGNITUDE OF DIFFERENCE BETWEEN CASE 2 AND CASE 3
			CASE 2	CASE 3	
	B. IMPACT				
	Residents (cont'd)				° overall, marginal preference for Case 2 based on access road impacts
	Community and Recreation Features				
Access Roads	° Disruption of operation of community and recreation features	1			° Case 2 and Case 3 have the same impact indices for community and recreation features along the access roads
	Land Use				
Site	° Proposed and planned land use	1	2	1	° facilities to be located on compatible industrially designated site (PI-27E)
Site Vicinity	° Proposed and planned land use	3	2	1	° substantially more compatible industrial lands near PI-27E than LF-1E

TABLE F.5

LOCATION OF PHYSICAL/CHEMICAL TREATMENT PLANT
STEP 2 - SYSTEMATIC REVIEW OF RANKINGS FOR ALTERNATIVES BY FACTOR
SITING OPTION: LF-1E/PI-27E

STUDY AREA	FACTOR GROUPING/ FACTOR	FACTOR RANK	PREFERENCE		MAGNITUDE OF DIFFERENCE BETWEEN CASE 2 AND CASE 3
			CASE 2	CASE 3	
	B. IMPACT				
	Land Use (cont'd)				
Access Roads	° Transportation impact index - (land use)				° screened
	° Overall land use		8	4	° Case 2 preferred for all land use factors
	Agriculture				
Site Vicinity	° Disruption of existing farm operations	3	2	1	° fewer farms will be disrupted for Case 2 (9 vs 27 headquarters)
	° Agricultural community impacts	3	2	1	° fewer impacts on agricultural community for PI-27E (less non-farm land, higher percent owned land, more large land parcels)
Access Roads	° Disruption of existing farm operations	3	2	1	° fewer access road impacts for PI-27E
	° Overall agriculture		18	9	° Case 2 preferred for all agricultural factors

TABLE F.5

LOCATION OF PHYSICAL/CHEMICAL TREATMENT PLANT
STEP 2 - SYSTEMATIC REVIEW OF RANKINGS FOR ALTERNATIVES BY FACTOR
SITING OPTION: LF-1E/PI-27E

STUDY AREA	FACTOR GROUPING/ FACTOR	FACTOR RANK	PREFERENCE		MAGNITUDE OF DIFFERENCE BETWEEN CASE 2 AND CASE 3
			CASE 2	CASE 3	
	B. IMPACT				
	Natural Environment				
Site	° Displacement of natural features	1	2	1	° affords greater opportunity to avoid biological resources
Access Roads	° Disruption of fish communities	2			° no preference ° no stream crossings containing significant fisheries
	° Overall natural environment		2	1	° preference for Case 2 based on on-site impacts only which are difficult to predict and of low importance
	Air Quality				
	° Restraints to dispersion	1			° no preference
	° Existing and anticipated air quality	1	1	2	° clear preference for separate incinerator for all indicators
	° Overall air quality		1	2	° preference for locating the physical/chemical treatment plant with the landfill at LF-1E based on one low importance factor only

TABLE F.5

LOCATION OF PHYSICAL/CHEMICAL TREATMENT PLANT
STEP 2 - SYSTEMATIC REVIEW OF RANKINGS FOR ALTERNATIVES BY FACTOR
SITING OPTION: LF-1E/PI-27E

STUDY AREA	FACTOR GROUPING/ FACTOR	FACTOR RANK	PREFERENCE		MAGNITUDE OF DIFFERENCE BETWEEN CASE 2 AND CASE 3
			CASE 2	CASE 3	
	C. ENGINEERING				
	° Capital and operating costs	none applied	2	1	° Case 2 considerably less expensive than Case 3 (approximately $20,000,000 difference in capital costs and $1,500,000 difference in 10-year operating costs)
	° Site area	none applied	2	1	° the separate landfill option allows a greater area for landfill development
	° Overall engineering		4	2	° clear preference for separate landfill with regard to costs and landfill life
	Total		65	40	° overall preference for Case 2

TABLE F.6

LOCATION OF PHYSICAL/CHEMICAL TREATMENT PLANT
STEP 2 - SYSTEMATIC REVIEW OF RANKINGS FOR ALTERNATIVES BY FACTOR
SITING OPTION: LF-4N/PI-13N

STUDY AREA	FACTOR GROUPING/ FACTOR	FACTOR RANK	PREFERENCE		MAGNITUDE OF DIFFERENCE BETWEEN CASE 2 AND CASE 3
			CASE 2	CASE 3	
	A. RISK				
	Transportation				
	° Transportation risk due to spills	3	2	1	° Case 2 preferred by all indicators ° largest difference of all options with regard to surface water
	° Transportation risk due to accidents	3	2	1	° Case 2 marginally preferred
	° Overall transportation		12	6	° Case 2 preferred for both spills and accidents
	Hydrogeology				° factor screened
	Air Quality				
	° Risks from direct inhalation of emissions-chronic	1			° existing population favours Case 2 but future population favours Case 3

TABLE F.6

LOCATION OF PHYSICAL/CHEMICAL TREATMENT PLANT
STEP 2 - SYSTEMATIC REVIEW OF RANKINGS FOR ALTERNATIVES BY FACTOR
SITING OPTION: LF-4N/PI-13N

STUDY AREA	FACTOR GROUPING/ FACTOR	FACTOR RANK	PREFERENCE		MAGNITUDE OF DIFFERENCE BETWEEN CASE 2 AND CASE 3
			CASE 2	CASE 3	
	A. RISK				
	Air Quality (cont'd)				
	° Risks from direct inhalation of emissions-acute	2	1	2	° three out of four indicators favoured Case 3
	° Risks from ingestion of cistern and pond water	1	1	2	° Case 3 preferred based on single indicator
	° Risks from consumption of crops and livestock	1			° no clear preference ° two indicators favour Case 2 and two indicators favour Case 3
	° Overall air quality		3	6	° clear preference for Case 3 based on acute risks and risks from ingestion of cistern and pond water ° acute risks most highly ranked air quality factor, therefore quantitative analysis shows Case 3 preferred (6 versus 3)

TABLE F.6

LOCATION OF PHYSICAL/CHEMICAL TREATMENT PLANT
STEP 2 - SYSTEMATIC REVIEW OF RANKINGS FOR ALTERNATIVES BY FACTOR
SITING OPTION: LF-4N/PI-13N

STUDY AREA	FACTOR GROUPING/ FACTOR	FACTOR RANK	PREFERENCE		MAGNITUDE OF DIFFERENCE BETWEEN CASE 2 AND CASE 3
			CASE 2	CASE 3	
	B. IMPACT **Residents**				
Site Vicinity	° Disruption of day-to-day activities and/or use and enjoyment of properties	3	2	2	° Case 2 has a greater potential impact due to a larger number of residents within the site noise impact zone
Access Roads	° Disruption of day-to-day activities and/or use and enjoyment of properties	3	1	2	° Case 2 has slightly higher noise impacts and slightly higher transportation impact index along access roads
Site Vicinity	° Existing land use (residences)	3	2	1	° considerably fewer residences (26) impacted in 1000 m study area for Case 2
	° Overall residents		12	15	° no preference for site vicinity impacts; noise impacts favour Case 3 and all other impacts favour Case 2; factors are ranked equally ° Case 3 marginally preferred with regard to access road impacts, therefore overall Case 3 preferred (15 versus 12)

TABLE F.6

LOCATION OF PHYSICAL/CHEMICAL TREATMENT PLANT
STEP 2 - SYSTEMATIC REVIEW OF RANKINGS FOR ALTERNATIVES BY FACTOR
SITING OPTION: LF-4N/PI-13N

STUDY AREA	FACTOR GROUPING/ FACTOR	FACTOR RANK	PREFERENCE		MAGNITUDE OF DIFFERENCE BETWEEN CASE 2 AND CASE 3
			CASE 2	CASE 3	
	B. IMPACT				
	Community and Recreation Features				
Access Roads	° Disruption of operations of community and recreation features	1			° no clear preference ° Case 2 has a slightly higher impact index for community and recreation features within 800 m of access road - Case 3 has a slightly higher impact index for features adjacent to the access route
	Land Use				
Site	° Proposed and planned land use	1			° no preference ° both sites have incompatible designations (agricultural)
Site Vicinity	° Proposed and planned land use	3			° no preference ° both sites are designated agricultural - a residential cluster near PI-13N would already be impacted by incinerator and no additional impacts assumed

TABLE F.6

LOCATION OF PHYSICAL/CHEMICAL TREATMENT PLANT
STEP 2 - SYSTEMATIC REVIEW OF RANKINGS FOR ALTERNATIVES BY FACTOR
SITING OPTION: LF-4N/PI-13N

STUDY AREA	FACTOR GROUPING/ FACTOR	FACTOR RANK	PREFERENCE		MAGNITUDE OF DIFFERENCE BETWEEN CASE 2 AND CASE 3
			CASE 2	CASE 3	
	B. IMPACT				
	Land Use (cont'd)				
Access Roads	° Transportation impact index (land use)				° screened
	° Overall land use				° no preference for any factors
	Agriculture				
Site Vicinity	° Disruption of existing farm operations	3			° minor differences in disruption (19 vs 20 headquarters)
Site Vicinity	° Agricultural community impacts	3			° minor differences in agricultural community characteristics
Access Roads	° Disruption of existing farm operations	3			° minor differences in access route impacts on farms or farm vehicles
	° Overall agriculture				° no overall preference or preference for any factor

TABLE F.6

LOCATION OF PHYSICAL/CHEMICAL TREATMENT PLANT
STEP 2 - SYSTEMATIC REVIEW OF RANKINGS FOR ALTERNATIVES BY FACTOR
SITING OPTION: LF-4N/PI-13N

STUDY AREA	FACTOR GROUPING/ FACTOR	FACTOR RANK	PREFERENCE		MAGNITUDE OF DIFFERENCE BETWEEN CASE 2 AND CASE 3
			CASE 2	CASE 3	
	B. IMPACT				
	Natural Environment				
Site	° Displacement of natural features	1	2	1	° affords greater opportunity to avoid biological resources
Access Roads	° Disruption of fish communities	2	2	1	° less potential impact on downstream fisheries
	° Overall natural environment		6	3	° overall preference for Case 2 based on both factors
	Air Quality				
Site Vicinity	° Restraints to dispersion	1	2	1	° marginal preference for Case 2
	° Existing and anticipated air quality	1	1	2	° marginal preference for Case 3
	° Overall air quality		3	3	° no clear preference; one factor favours Case 2 and the other Case 3 and they are equally weighted

TABLE F.6

LOCATION OF PHYSICAL/CHEMICAL TREATMENT PLANT
STEP 2 - SYSTEMATIC REVIEW OF RANKINGS FOR ALTERNATIVES BY FACTOR
SITING OPTION: LF-4N/PI-13N

STUDY AREA	FACTOR GROUPING/ FACTOR	FACTOR RANK	PREFERENCE		MAGNITUDE OF DIFFERENCE BETWEEN CASE 2 AND CASE 3
			CASE 2	CASE 3	
	C. ENGINEERING				
	° Capital and operating costs	none applied	2	1	° Case 2 considerably less expensive than Case 3 ($15,515,000 difference in capital cost and $1,155,000 difference in 10 year operating cost)
	° Site area	none applied	2	1	° the separate landfill option allows a greater area for landfill development
	° Overall engineering		4	2	° definite preference for Case 2
	Total		40	35	° overall marginal preference for Case 2

TABLE F.7

LOCATION OF PHYSICAL/CHEMICAL TREATMENT PLANT
STEP 2 - SYSTEMATIC REVIEW OF RANKINGS FOR ALTERNATIVES BY FACTOR
SITING OPTION: LF-4N/PI-1N

STUDY AREA	FACTOR GROUPING/ FACTOR	FACTOR RANK	PREFERENCE		MAGNITUDE OF DIFFERENCE BETWEEN CASE 2 AND CASE 3
			CASE 2	CASE 3	
	A. RISK				
	Transportation				
	° Transportation risk due to spills	3	2	1	° Case 2 preferred due to differences in surface water risks; little difference in other risks
	° Transportation risk due to accidents	3	1	2	° marginal preference for Case 3 in terms of road user risk due to accidents
	° Overall transportation		9	9	° Case 2 marginally preferred due to differences in surface water spills risk; little difference in other risks for spills and accidents
					° spills and accidents factors ranked equally
	Hydrogeology				° factor screened
	Air Quality				
	° Risks from direct inhalation of emissions-chronic	1			° no preference; existing population favours Case 2 but future population favours LF-4N

TABLE F.7

LOCATION OF PHYSICAL/CHEMICAL TREATMENT PLANT
STEP 2 - SYSTEMATIC REVIEW OF RANKINGS FOR ALTERNATIVES BY FACTOR
SITING OPTION: LF-4N/PI-1N

STUDY AREA	FACTOR GROUPING/ FACTOR	FACTOR RANK	PREFERENCE		MAGNITUDE OF DIFFERENCE BETWEEN CASE 2 AND CASE 3
			CASE 2	CASE 3	
	A. RISK				
	Air Quality (cont'd)				
	° Risks from direct inhalation of emissions-acute	2	1	2	° definite preference for Case 3 for acute emissions which is considered as most important air quality factor
	° Risks from ingestion of cistern and pond water	1	2	1	° marginal preference for Case 2 based on single indicator
	° Risks from consumption of crops and livestock	1	2	1	° all indicators show preference for Case 2
	° Overall air quality		6	6	° quantitative analysis indicates no preference; acute risks ranked most highly and favour Case 3. This factor considered to be marginally more important than the two indirect pathway factors; therefore Case 3 (separate incinerator) marginally preferred by air quality consultants

TABLE F.7

LOCATION OF PHYSICAL/CHEMICAL TREATMENT PLANT
STEP 2 - SYSTEMATIC REVIEW OF RANKINGS FOR ALTERNATIVES BY FACTOR
SITING OPTION: LF-4N/PI-1N

STUDY AREA	FACTOR GROUPING/ FACTOR	FACTOR RANK	PREFERENCE		MAGNITUDE OF DIFFERENCE BETWEEN CASE 2 AND CASE 3
			CASE 2	CASE 3	
	B. IMPACT				
	Residents				
Site Vicinity	° Disruption of day-to-day activities and/or use and enjoyment of properties	3	1	2	° Case 2 has a greater number of residents within the noise impact zone around the site (98 versus 27)
Access Roads	° Disruption of day-to-day activities and/or use and enjoyment of properties	3	1	2	° Case 2 has a greater number of residents within the noise impact zones along access roads (740 versus 694) ° Case 3 has a slightly higher impact index for residents adjacent to and within 800 m of access roads
Site Vicinity	° Existing land use (residences)	3	2	1	° considerably fewer residences (42) impacted in 1000 m study area for Case 2
	° Overall residents		12	15	° no clear preference for the site vicinity study area; Case 2 greater noise impacts, but for Case 3 other impacts in the site vicinity are greater

TABLE F.7

LOCATION OF PHYSICAL/CHEMICAL TREATMENT PLANT
STEP 2 - SYSTEMATIC REVIEW OF RANKINGS FOR ALTERNATIVES BY FACTOR
SITING OPTION: LF-4N/PI-1N

STUDY AREA	FACTOR GROUPING/ FACTOR	FACTOR RANK	PREFERENCE		MAGNITUDE OF DIFFERENCE BETWEEN CASE 2 AND CASE 3
			CASE 2	CASE 3	
	B. IMPACT				
	Residents (cont'd)				° marginal preference for Case 3 for access routes based on difference in noise impacts ° overall, marginal preference for Case 3 based on access route impacts on residents (15 versus 12)
	Community and Recreation Features				
Access Roads	° Disruption of operations of community and recreation features	1	1	2	° Case 3 has a slightly higher impact index for community and recreation features adjacent to the access road ° Cases 2 and 3 have the same impact index for community and recreation features within the 800 m study area of the access road
	Land Use				
Site	° Proposed and planned land use	1			° no preference

TABLE F.7

LOCATION OF PHYSICAL/CHEMICAL TREATMENT PLANT
STEP 2 - SYSTEMATIC REVIEW OF RANKINGS FOR ALTERNATIVES BY FACTOR
SITING OPTION: LF-4N/PI-1N

STUDY AREA	FACTOR GROUPING/ FACTOR	FACTOR RANK	PREFERENCE		MAGNITUDE OF DIFFERENCE BETWEEN CASE 2 AND CASE 3
			CASE 2	CASE 3	
	B. IMPACT				
	Land Use (cont'd)				° both sites have incompatible designations (agricultural, with sanitary landfill on LF-4N)
Site Vicinity	° Proposed and planned land use	3			° no preference ° no difference in designations in site vicinity
Access Roads	° Transportation impact index (land use)				° screened
	° Overall land use				° no preference for either factor
	Agriculture				
Site Vicinity	° Disruption of existing farm operations	3	2	1	° minor differences between Case 2 and Case 3 (2 less farm headquarters)
Site Vicinity	° Agricultural community impacts	3	2	1	° minor differences between Case 2 and Case 3 (less fragmentation, less farmland owned, more non-farm land for PI-1N)

TABLE F.7

LOCATION OF PHYSICAL/CHEMICAL TREATMENT PLANT
STEP 2 - SYSTEMATIC REVIEW OF RANKINGS FOR ALTERNATIVES BY FACTOR
SITING OPTION: LF-4N/PI-1N

STUDY AREA	FACTOR GROUPING/ FACTOR	FACTOR RANK	PREFERENCE		MAGNITUDE OF DIFFERENCE BETWEEN CASE 2 AND CASE 3
			CASE 2	CASE 3	
	B. IMPACT				
	Agriculture (cont'd)				
Access Roads	° Disruption of existing farm operations	3	2	1	° minor differences between Case 2 and Case 3 ° disruption to farm operations and farm machinery movements is less for Case 2
	° Overall agriculture		18	9	° Case 2 preferred for all agricultural factors
	Natural Environment				
Site	° Displacement of natural features	1	2	1	° affords greater opportunity to avoid biological resources
Access Roads	° Disruption of fish communities	2	2	1	° less potential impact on downstream fisheries
	° Overall natural environment		6	3	° Case 2 preferred for all natural environment factors

TABLE F.7

LOCATION OF PHYSICAL/CHEMICAL TREATMENT PLANT
STEP 2 - SYSTEMATIC REVIEW OF RANKINGS FOR ALTERNATIVES BY FACTOR
SITING OPTION: LF-4N/PI-1N

STUDY AREA	FACTOR GROUPING/ FACTOR	FACTOR RANK	PREFERENCE		MAGNITUDE OF DIFFERENCE BETWEEN CASE 2 AND CASE 3
			CASE 2	CASE 3	
	B. IMPACT				
	Air Quality				
Site Vicinity	° Restraints to dispersion	1			° no preference
	° Existing and anticipated air quality	1			° no preference
	° Overall air quality				° no preference

TABLE F.7

LOCATION OF PHYSICAL/CHEMICAL TREATMENT PLANT
STEP 2 - SYSTEMATIC REVIEW OF RANKINGS FOR ALTERNATIVES BY FACTOR
SITING OPTION: LF-4N/PI-1N

STUDY AREA	FACTOR GROUPING/ FACTOR	FACTOR RANK	PREFERENCE		MAGNITUDE OF DIFFERENCE BETWEEN CASE 2 AND CASE 3
			CASE 2	CASE 3	
	C. ENGINEERING				
	° Capital and operating costs	none applied	2	1	° Case 2 considerably less expensive than Case 3 ($16,644,000 difference in capital costs estimated and approximately $1,300,000 difference in 10-year operating costs
	° Site area	none applied	1	1	° the separate landfill option allows a greater area for landfill development
	° Overall engineering		4	2	° overall clear preference for Case 2 with regard to engineering
	Total		56	46	° overall marginal preference for Case 2

APPENDIX G

(APPENDIX TO CHAPTER 8)

Table G.1

Community Suggestions - Basic Acceptability

Site	Concern	Response
Milton		
PI-13N	° shale bedrock is shallow	° site excluded because of failure to provide natural containment (GLAL, 1985a)
LF-4N/PI-1N	° proximity to Milton hospital	° site located approximately 3 km from facility ° generic risk assessment suggests air emissions represent minimal health risk (Environ, 1985) ° air emissions well within applicable provincial standards (ORF, 1985) ° at 3 km disruption as a result of noise, odours, etc. expected to be minimal (IER, 1985), (Monenco, 1985), (MMD, 1985b), (ORF, 1985) ° hospital not located on any of the primary access routes to or between sites (MMD, 1985b)
PI-1N	° proximity to Niagara Escarpment - air dispersion constraint	° dispersion analysis indicated that Niagara Escarpment minimal constraint to dispersion (ORF, 1985a) ° analysis indicated that any minor restraints to dispersion can be mitigated through design or operations (ORF, 1985a)
LF-4N/PI-1N LF-4N/PI-13N	° proximity to proposed Glenorchy Conservation Area	° site closest to conservation area (PI-13N) excluded on basic acceptability grounds (GLAL, 1985a) ° conservation area sufficient setback from Britannia Road and Highway 25 that should represent negligible health risk and minimal noise impact (IER, 1985), (MMD, 1985b)

Table G.1

Community Suggestions - Basic Acceptability

Site	Concern	Response
Milton		
LF-4N/PI-1N LF-4N/PI-13N		° small proportion of current and anticipated traffic load on Britannia Road and Highway 25 OWMC related (MMD, 1985b) ° period of peak traffic for OWMC facility and for conservation area largely not expected to conflict
Mississauga		
LF-2N	° site centred on highly urbanized, fast growing metropolitan area	° site excluded because of failure to provide natural containment (GLAL, 1985a)
West Lincoln		
LF-3C LF-9C	° local and regional access roads to West Lincoln sites - existing traffic conflicts with pedestrian traffic and school buses, risk to residents	° risk from spills relatively remote; where health threatening special waste spills: LF-9C - 1 every 48.3 years for motor vehicle accident-related spills - 1 every 35.2 years for non-motor vehicle accident-related spills - 1 every 20.4 years - total all types of spills LF-3C - 1 every 33.6 years for motor vehicle accident-related spills - 1 every 21.1 years for non-motor vehicle accident-related spills - 1 every 13.0 years - total all types of spills (MMD, 1985b)

Table G.1

Community Suggestions - Basic Acceptability

Site	Concern	Response
West Lincoln LF-3C LF-9C (cont'd)		° likelihood of spill at a point where represents direct risk to human health even more remote ° OWMC traffic small proportion of traffic volumes on local and regional access system; for regional component, which makes up most of route, 0.6% to 3% of volume for LF-9C and 0.6% to 12% for LF-3C; local road to LF-3C (Krick Road) to be upgraded to provincial standards (MMD, 1985b) ° in view of current and anticipated volumes, as well as present requirements, i.e. school bus and pedestrian movement, minimal conflict beyond present situation envisioned (MMD, 1985b) ° no well-defined threshold of acceptability ° anticipated level of risks and impacts expected to be moderate to low ° some potential for mitigation, e.g. operating hours, driver training, road improvement ° options (on province-wide basis) clustered relatively close together (MMD, 1985b) ° exclusion of sites on this basis would have meant higher relative risks and impacts for certain

Table G.1

Community Suggestions - Basic Acceptability

Site	Concern	Response
West Lincoln LF-3C LF-9C (cont'd)		other factors, e.g. hydrogeology, for remaining sites; only way to address such tradeoffs as part of comparative evaluation
LF-3C	° potential risk to surface water	° facility layout does not impinge upon Beaver Creek (GLAL, 1985b) ° surface water team recommended operations component at least 100 m from floodplain; actual setback approximately 200 m; as a result of modifications, potentially severe flooding constraint removed (GLAL, 1985b) ° residual risk considered mitigable through design modifications; modifications include regrading and berming on site, storm water management ponds and/or culvert replacements downstream channelizations and redirection of runoff (GLAL, 1985b), (Monenco, 1985b)
LF-9C	° site located over regionally significant aquifer	° bedrock aquifer afforded long-term protection by thick layer of clay (GLAL, 1985b) ° confining layer is uniform and laterally and vertically continuous (GLAL, 1985a) ° estimated breakthrough time 760-1100 years (GLAL, 1985a) ° ground water resources used in vicinity of all candidate sites (GLAL, 1985a) ° no clearly defined threshold of acceptability ° difficult to predict or control future ground water use

Table G.1

Community Suggestions - Basic Acceptability

Site	Concern	Response
West Lincoln		
LF-3C LF-9C	° agricultural community	° estimated risk to human health through crop and livestock consumption extremely low and well within standards applied in other jurisdictions (Environ, 1985a) ° well within applicable air quality standards (ORF, 1985a) ° no regulations, standards, criteria or guidelines which establish relevant threshold of acceptability, i.e. agricultural community effects (Ecologistics, 1985a) ° threshold not well-defined ° uncertainty, i.e. severity of impacts expected to be moderate ° some potential for mitigation/compensation ° specialty crops and highest capability land excluded during previous stages ° small area of land involved ° exclusion of Niagara sites would limit site selection process to sites characterized by much higher relative risks and impacts for other factors; only way of addressing tradeoffs through comparative analysis
	° community character	° no widely affected standard to judge social acceptability (IER, 1985a) ° on-site impacts largely mitigable (IER, 1985a) ° site vicinity impact moderate and potential for mitigation and compensation

Table G.1

Community Suggestions - Basic Acceptability

Site	Concern	Response
West Lincoln LF-3C LF-9C (cont'd)		° potential for mitigation, compensation, monitoring to address community concerns and impacts (IER, 1985a) ° no well-defined thresholds ° uncertainty, i.e. severity
	° cancer rates in Niagara Region	° estimated risk of cancer using conservative assumptions: one-in-a-million (1 x 10^{-6}) ° air emissions well within applicable standards and guidelines ° anticipated risks within standards accepted in other jurisdictions ° cancer risks much lower than common risks frequently faced, e.g. one pint of milk a day (1.4 x 10^{-4}) ° risk from facility an extremely small fraction of all cancers ° risks lower than other forms of development, e.g. industry and development-related activities, e.g. traffic
Niagara Falls LF-1E/PI-27E	° impact on tourism	° impact likely to be short-lived as Niagara Falls is a powerful tourist draw (IER, 1985a)

Table G.1

Community Suggestions - Basic Acceptability

Site	Concern	Response
Niagara Falls		
LF-1E/PI-27E (cont'd)		° comparable use review suggested that attendance would not be affected by facility or hearings (IER, 1985a) ° potential sites are 5.5 km and 8 km from Horseshoe Falls (IER, 1985a) ° Niagara Falls and Niagara Region are home to major heavy industries and have been so for many decades (IER, 1985a) ° PI-27E is designated for industry and is adjacent to industry (IER, 1985a) ° impacts expected to be minimal and short-term (IER, 1985a) ° potential for mitigation ° uncertainty, i.e. severity ° threshold not well-defined
	° cancer rates in Niagara Region	° see LF-3C/LF-9C
	° agriculture in Niagara Region	° see LF-3C/LF-9C, also: ° PI-27E designated for industrial use (LKA, 1985) ° LF-1E in proximity to industrial built-up area ° LF-1E subject to urbanization pressures; only 17% of rural residences in site vicinity are farm residences; only 39% of land that is farmed in site vicinity is owned by farmers (Ecologistics, 1985a)

Volume

2

Final report

OWMC
Ontario
Waste Management
Corporation

A provincial crown corporation.

DILLON

SITE SELECTION PROCESS
PHASE 4A: SELECTION OF A PREFERRED SITE(S)
SITE SELECTION
Volume 2 - Part 1

June, 1986

This document consists of Part 1 (Chapters 1-4) of Volume 2 of Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Site Selection. Chapter 1 provides an Introduction to Volume 2. Chapters 2 and 3 document the Existing Environment and Design Modifications, respectively. Factor Identification, Refinement and Ranking is presented in Chapter 4.

Technical appendices which accompany these four chapters are bound under a separate cover. Technical appendices A and B are bound as Volume 2 - Technical Appendices - Part 1.

DILLON
Consulting Engineers & Planners

OUR FILE: 1106-21-2
YOUR FILE:

26 June 1986

Dr. B.D. Mitchell
Director of Corporate Planning
and Development
Ontario Waste Management Corporation
11th Floor, 2 Bloor Street West
Toronto, Ontario
M4W 3W2

Attention: Mr. J.G. Micak,
Manager, Environmental Projects

Site Selection Process
Phase 4A: Selection of a Preferred Site(s) -
Site Selection - Volume 2

Dear Sirs:

We are pleased to submit Volume 2 of our two-volume report - Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Site Selection. The report provides the technical documentation of the activities undertaken by a team of site selection consultants in the comparison of eight candidate sites. It also addresses the major reasons for the Phase 4A interpretations and conclusions reached by the site selection team and by the site selection coordinating consultant, M.M. Dillon Limited.

This volume provides an overview of existing conditions at the six siting options considered in the detailed comparative evaluation. Site-specific design modifications for each candidate site are also provided. The process used to identify, refine and rank the factors used to compare siting options is described. The volume documents the four evaluation procedures employed in the detailed comparative evaluation of siting options - the differences and trade-offs synthesis, the

.../page 2

disciplinary synthesis and two quantitative aggregation procedures. In addition, a number of sensitivity analyses are documented to determine whether the ranking of siting options would change with alternative assumptions. A series of conclusions and recommendations are also provided.

Yours truly,

M.M. DILLON LIMITED

David P. Lawrence, M.C.I.P.
Site Selection Manager

DPL:ch
Encl.

SITE SELECTION PROCESS
PHASE 4A: SELECTION OF PREFERRED SITE(S)
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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of Phase 4A of the Ontario Waste Management Corporation's (OWMC) site selection process was to select a preferred site(s)* for a special waste* treatment and disposal facility[1]. This report, Site Selection Process, Phase 4A: Selection of a Preferred Site(s) - Site Selection, prepared by M.M. Dillon Limited, provides the technical documentation of the role assumed by a team of site selection consultants in the comparison of eight candidate sites (see Figure 1.1).

This volume, which is bound as Parts 1 and 2, represents the second of a two volume report. Technical appendices to Volume 2 are also bound separately as Parts 1 and 2. The two volumes document the following:

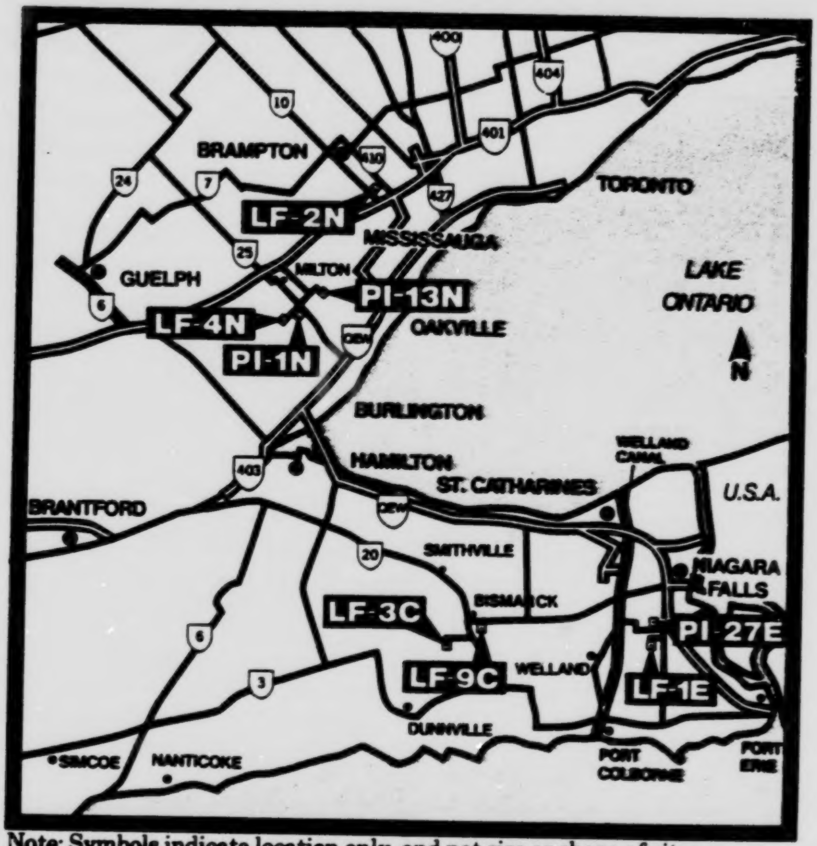
- Volume 1 provides background information on the OWMC site selection process and an overview of the Phase 4A approach including a description of such matters as goals* and objectives*, factors* and indicators*, roles and responsibilities, study areas* and time horizons, and facilities characteristics assumptions*. Volume 1 also documents the four elements of the siting

---

[1] This report uses a great many terms of a technical nature or in a particular manner. A glossary of these terms is provided at the back of the volume. The first time that each of these terms appears in the volume it is marked by an asterisk.

FIGURE 1.1

CANDIDATE SITES - SITE LOCATION


400
404
10
401
BRAMPTON
410
24
7
427
TORONTO
LF-2N
MISSISSAUGA
25
GUELPH
MILTON
PI-13N
LAKE ONTARIO
6
LF-4N
OAKVILLE
QEW
PI-1N
N
BURLINGTON
WELLAND CANAL
HAMILTON
403
ST. CATHARINES
U.S.A.
BRANTFORD
QEW
SMITHVILLE
20
NIAGARA FALLS
BISMARCK
LF-3C
PI-27E
6
WELLAND
LF-9C
3
LF-1E
DUNNVILLE
SIMCOE
NANTICOKE
PORT COLBORNE
FORT ERIE

Note: Symbols indicate location only, and not size or shape of sites.

Site Name	Landfill	Physical/ Chemical	Incinerator	
LF-2N	●	●		
LF-4N	●	●		
LF-3C	●	●	●	Integrated
LF-9C	●	●	●	Integrated
LF-1E	●	●	●	Integrated
PI-1N		●	●	
PI-13N		●	●	
PI-27E		●	●	

OWMC, 1985.

LEGEND

■ Candidate Sites

═ 400 Series Highways

— Other Highways & Roads

0 10
Kilometres
0 10
Miles

option refinement (i.e. refinement of site boundaries, access road options, rail access options, location of physical/chemical treatment plant for partially integrated siting options) and provides the results for each of these analyses. The basic acceptability analysis*, which determined whether new constraints* identified during Phase 4A precluded the use of a site(s), is documented in the final chapter of this volume. Technical appendices to Volume 1 are bound separately;

- Volume 2 describes the existing conditions associated with the environment potentially affected by the OWMC facility. It highlights site-specific design modifications, the process employed to identify, refine and rank evaluation factors, and the comparative evaluation process. This volume presents four evaluation procedures used to compare the six siting options - a synthesis based upon a review of major differences and tradeoffs* using a paired comparison approach, a disciplinary synthesis, and two quantitative aggregation procedures. Volume 2 also presents a series of analyses undertaken to determine the sensitivity of the ranking of siting options* to alternative assumptions and overall conclusions and recommendations.

1.2 EVALUATION METHODS

The evaluation of the six siting options* involves the integration of a great deal of data. It also involves a range of disciplinary perspectives, a diversity of issues and concerns raised by agencies and the public, and a large number of difficult interpretations and tradeoffs. Depending on the way in which this array of information and interpretation is integrated, it is very possible that conflicting conclusions could be reached. In order to allow for such variations, four evaluation procedures have been employed. Each procedure has served as a cross-check to the other procedures. The procedures include:

1. The synthesis of disciplinary perspectives (Chapter 6). The basic building blocks for this analysis are the disciplinary/professional judgements and conclusions of the individual site selection consultants;

2. The identification of major differences and tradeoffs between siting options using a paired comparison process (Chapter 5). The basic building blocks for this analysis are the individual site selection factors;

3. & 4. The quantitative aggregation* of factors* (two procedures) (Chapter 7). These analyses derive siting option rankings by summing the product of factor rankings* and factor suitability levels*.

Each of these procedures:

- builds upon the consultants' data, analyses, interpretations and conclusions;

- draws upon the judgements and interpretations reached through factor identification, refinement and ranking;

- directly or indirectly incorporates agency and public inputs;

- represents a staged evaluation procedure. Each step in the procedure is detailed, including relevant definitions, judgements, and conclusions.

As indicated in Table 1.1, each of the procedures possesses various strengths and limitations. Many of the limitations of one procedure represent strengths of the other procedures. Thus the procedures serve as cross-checks against one another. A further cross-check against all the procedures is a series of quantitative and qualitative analyses which test the sensitivity of conclusions to alternative:

TABLE 1.1

Strengths and Limitations of Phase 4A Evaluation Process

DISCIPLINARY SYNTHESIS		DIFFERENCES AND TRADEOFFS		QUANTITATIVE AGGREGATION	
STRENGTHS	LIMITATIONS	STRENGTHS	LIMITATIONS	STRENGTHS	LIMITATIONS
• maintains overall disciplinary perspective • draws upon consultants' reasoning and interpretations • provides for overall ranking of options • reasoned arguments; rationale for conclusions and value judgements provided • addresses absolute risks and impacts, relative risks and impacts, mitigation potential, policy concerns and uncertainties • enables detailed evaluation of tradeoffs • enables consideration of unique siting option attributes and constraints • preferences regarding relative importance	• primarily focuses on tradeoffs among disciplines • relies on consultants' incorporation of agency and public concerns • weighting process not fully explicit; does not always affect decision outcome • danger of implicit and/or inconsistent judgements • although can be adjusted to alter assumptions not as flexible as quantitative approach • danger of counting disciplines for and against an option even when relative importance of disciplines for particular choices varies	• addresses tradeoffs both within and among disciplines • maintains an overall study area perspective - reduces potential for double counting within study areas • incorporates agency and public concerns directly into evaluation process • reasoned arguments, rationale for conclusions and value judgements provided • focuses on differences and tradeoffs rather than counting disciplines • enables consideration of unique siting option attributes and constraints • preferences regarding relative importance of risks and impacts a reflection of both initial preferences	• fails to maintain overall disciplinary perspective; does not fully draw upon consultants' reasoning and interpretations • does not provide basis for overall ranking of options • weighting process not fully explicit; does not always directly affect outcome • indirect treatment of absolute risks, mitigation potential and policy concerns • although can be adjusted to alter assumptions not as flexible as quantitative approach • danger of implicit and/or inconsistent judgements • analysis limited to major differences and tradeoffs	• provides basis for overall ranking of options • weighting process explicit and directly affects outcome • highly flexible process, e.g. alternative weights, facilities characteristics assumptions and judgements regarding predicted risks and impacts, steps to exclude double counting • provides for differences in relative importance of disciplines • aggregation of impacts on both a disciplinary and a study area basis • addresses all differences between options • builds upon consultants' quantitative analyses	• fails to maintain overall disciplinary perspective • does not draw upon consultants reasoning and interpretations • only indirectly incorporates public and agency concerns, e.g. through factor suitability levels and factor rankings • reasoning process not as evident and important judgements may be hidden, i.e. numbers rather than reasons • indirect treatment of absolute risks, mitigation potential, policy concerns, i.e. to the extent that reflected in factor rankings and factor suitability levels • does not focus analysis on major differences and tradeoffs • restricted in ability to consider unique

TABLE 1.1

Strengths and Limitations of Phase 4A Evaluation Process

DISCIPLINARY SYNTHESIS		DIFFERENCES AND TRADEOFFS		QUANTITATIVE AGGREGATION	
STRENGTHS	LIMITATIONS	STRENGTHS	LIMITATIONS	STRENGTHS	LIMITATIONS
of risks and impacts a reflection of both initial preferences and interpretations of site-specific conditions • assists in addressing "major" concerns and tradeoffs • minimizes information loss • reasoned arguments tend to be more readily understandable to decision-makers and the public • of greater value when subtle differences between options with difficult tradeoffs • addresses actual risks and impacts rather than composite numerical indices	• analysis limited to major differences and tradeoffs • does not fully draw upon consultants' quantitative analyses	and interpretations of site-specific conditions • assists in addressing and resolving major concerns and tradeoffs • minimizes information loss • reasoned arguments tend to be more readily understandable to decision-makers and the public • of greater value when subtle differences between options involving difficult tradeoffs • addresses actual risks and impacts rather than composite numerical indices	• does not fully draw upon consultants' quantitative analyses	• consistent, systematic and traceable process • useful in identifying clearly less suitable options • useful cross-check of qualitative analyses • uncertainty and error can be built in explicitly	siting attributes and constraints • assumes that preferences regarding relative importance of risks and impacts can be established at outset of evaluation process and do not change with additional information • provides little guidance for addressing major concerns or for resolving major tradeoffs • considerable information loss

- facilities characteristics assumptions;
- mitigation* and compensation assumptions;
- study areas and time horizons;
- factor rankings and weights;
- risk* and impact* predictions.

1.3 COMPARATIVE EVALUATION PROCESS

The process employed to compare the six siting options (after siting option refinement and the basic acceptability analysis) is illustrated in Figure 1.2.

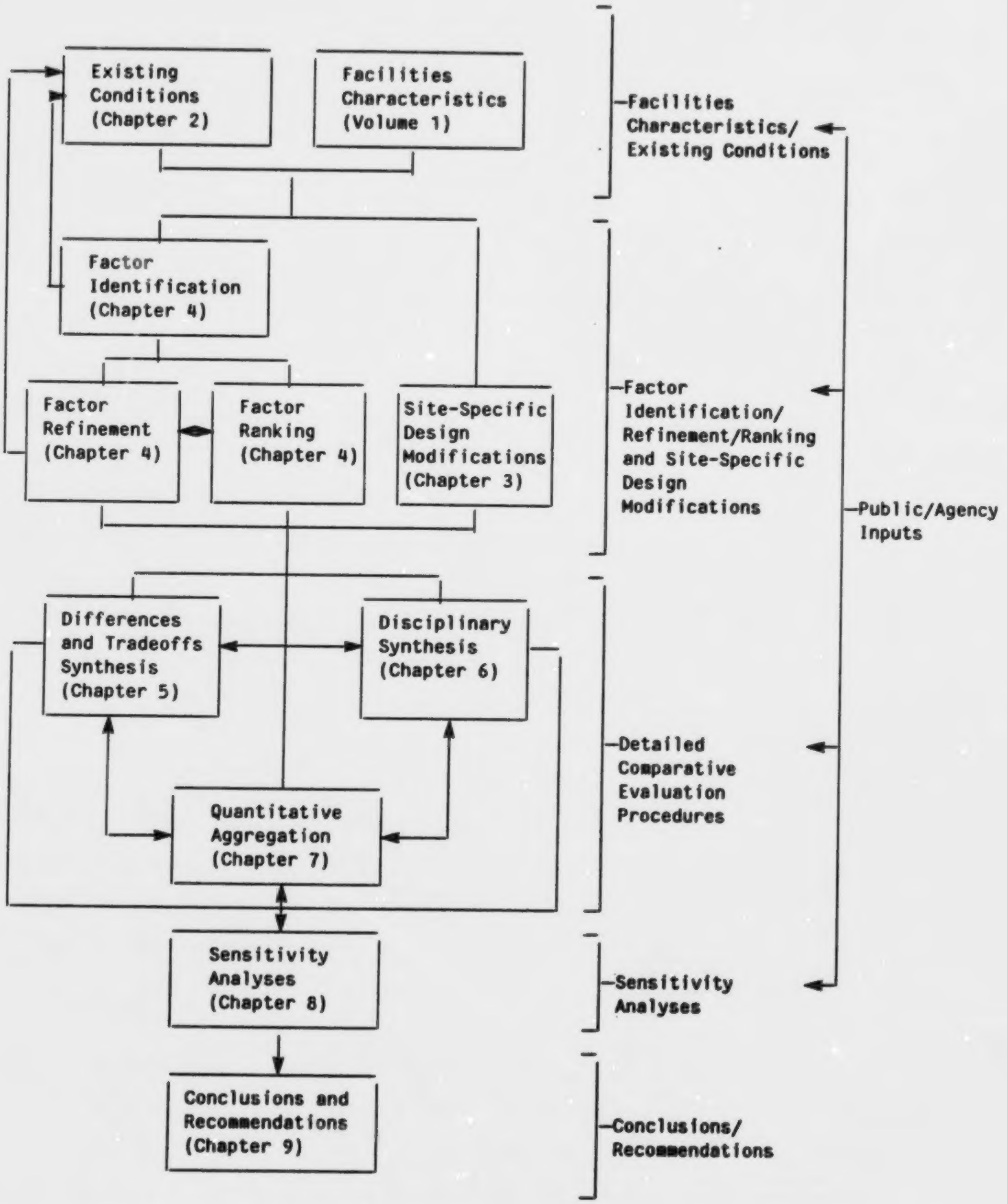
As indicated in Figure 1.2, a review of facilities characteristics and existing conditions contributed to the initial identification of factors and to site-specific design modifications. The initial factor list provided the basis for the detailed analysis of existing conditions - on-site, in the site vicinity, along access roads* to the sites and within the community and region* surrounding each siting option. As the existing conditions analysis proceeded, factors were refined. The process of ranking factors proceeded in parallel with factor refinement.

The analysis of existing conditions, the factor refinement and ranking and the site-specific design modifications provided the inputs necessary to undertake the four evaluation procedures - the differences and tradeoffs synthesis, the disciplinary synthesis and the two quantitative aggregation procedures. A series of analyses were then undertaken to test the sensitivity of the results of each procedure to alternative assumptions.

The results of each procedure, including the sensitivity analyses, were then reviewed and compared in deriving overall conclusions and recommendations. These conclusions and recommendations addressed both the results of the Phase 4A analysis and areas where further analysis was considered desirable.

FIGURE 1.2

Detailed Comparative Evaluation Process


Existing Conditions (Chapter 2)
Facilities Characteristics (Volume 1)
Facilities Characteristics/ Existing Conditions
Factor Identification (Chapter 4)
Factor Refinement (Chapter 4)
Factor Ranking (Chapter 4)
Site-Specific Design Modifications (Chapter 3)
Factor Identification/ Refinement/Ranking and Site-Specific Design Modifications
Public/Agency Inputs
Differences and Tradeoffs Synthesis (Chapter 5)
Disciplinary Synthesis (Chapter 6)
Quantitative Aggregation (Chapter 7)
Detailed Comparative Evaluation Procedures
Sensitivity Analyses (Chapter 8)
Sensitivity Analyses
Conclusions and Recommendations (Chapter 9)
Conclusions/ Recommendations

As indicated in Figure 1.2, public and agency review was incorporated into each step in the detailed comparative evaluation process. Public and agency inputs into each of these steps are described in Appendices B, C, and D.

Appendix tables detailing public and agency inputs include:

- changes to factors (Tables B.5 and B.6);
- public inputs to factor ranking (Tables B.8, B.9, B.10, B.11 and B.12);
- responses to issues raised by the public and agencies through submissions and meetings in site selection (Table C.7);
- issues raised by the public and agencies - frequency of occurrence and relationship to site selection factors (Table C.8);
- issues raised by the public and agencies related to mitigation and compensation (Table C.9);
- issues raised by the public and agencies but not related to a specific factor (Table C.10).

A description of the public's role in the refinement of siting options and the basic acceptability analysis is provided in Volume 1. Specific references to public inputs to site selection, as derived through the OWMC public consultation program*, are also made where relevant throughout this report.

Public inputs were invited in three ways in Phase 4A. Public comments and reactions were requested through public consultation activities designed for a specific purpose (e.g. public review of preliminary Phase 4A factors and factor ranking). Public and agency inputs were obtained through review of submissions made to OWMC during Phase 4A and a review of records of meetings held with the public, agencies, site selection consultants and OWMC staff. In addition, the site selection consultants met with public and agency representatives individually and through workshops. The consultants incorporated public and agency input into their individual analyses. The latter inputs are recorded in the individual site selection reports listed in the references to this volume.

1.4 EVALUATION PRESENTATION

The presentation of the comparative evaluation of the six siting options must address a range of requirements. It must, for example:

- detail the application of each of the various evaluation procedures employed;
- provide a traceable evaluation process so that reviewers can understand the basis for judgements made in each stage in the process;
- present all the major items of information and interpretation employed in the evaluation process;
- make value judgements explicit and substantiate those judgements;
- facilitate cross-referencing to support materials and the technical reports of other site selection consultants;
- indicate the points at which agency and public concerns were incorporated into the evaluation process.

The inevitable outcome of satisfying the requirements listed above is a lengthy report which cannot be quickly read or readily understood. To some extent, this potential limitation is ameliorated with the use of an executive summary, figures, summary tables, maps, appendices, and introductory and concluding sections. Brief summary materials are also provided through OWMC summary reports and documents. However, to further abbreviate the materials contained in the volume would seriously inhibit the presentation of a comprehensive step-by-step description of the comparative evaluation process.

1.5 VOLUME FORMAT

Volume 2 consists of the following chapters: [1]

- Chapter 1 (this chapter) is the introduction;
- Chapter 2 provides an overview of existing conditions at the six siting options - LF-4N/PI-1N, LF-4N/PI-13N, LF-3C, LF-9C, LF-1E and LF-1E/PI-27E;
- Chapter 3 presents site-specific design modifications for each candidate site. The chapter initially reviews specific engineering changes to the initial base case facility design. Subsequent sections define the base case, the general nature of the changes undertaken and specific modifications for each site;
- Chapter 4 documents the process used to identify, refine and rank the the factors used to compare siting options. The considerations applied to identify and refine factors are described. This chapter also details the process for ranking the risk and impact factors;
- Chapter 5 documents the procedure employed to evaluate the major differences and tradeoffs between the siting options through a paired comparison approach;

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[1] Chapters 1 to 4 are bound as Volume 2 - Part 1. Chapters 5 to 9 are bound as Volume 2 - Part 2.

- Chapter 6 documents the disciplinary synthesis procedure. This procedure draws upon the reasoning and interpretations contained in the individual site selection reports and obtained from the site selection team;

- Chapter 7 documents two quantitative approaches to the aggregation of factors;

- Chapter 8 presents a number of sensitivity analyses* undertaken to determine whether the ranking of siting options would change with alternative assumptions;

- Chapter 9 provides a review of the differences among the results of the differences and tradeoffs synthesis, the disciplinary synthesis, the quantitative aggregation procedures and the sensitivity analyses. Chapter 9 also provides a series of conclusions and recommendations.

2.0 EXISTING ENVIRONMENT

2.1 INTRODUCTION

This chapter describes the existing environment of each of the six siting options.

The environmental descriptions generally reflect the factor groupings* used in the comparative evaluation. Data are presented by risk factors (within four risk pathways*) and by impact factors (within four study areas).

This chapter describes the existing environment following boundary refinement of the six siting options. Detailed data matrices*, presenting the data for each factor and indicator used in the comparative analysis, are provided in Appendix A. The descriptions in this chapter and the data in the matrices were compiled from information provided by the various site selection consultants. Table 2.3 in Volume 1 of this report describes the site selection consultants' major areas of technical responsibility. Reference should be made to the reports of each of the site selection consultants for a more detailed description of the existing environment of each of the siting options. Maps 1 to 6 illustrate the major features* for each siting option and are located at the back of this volume.

Information regarding existing conditions was obtained from the public in Phase 4A. A field research program was undertaken as part of the Phase 4A site selection data collection process. The "Walk and Talk" program consisted of personal interviews or drop-off surveys with landowners and residents on and around each site as well as along local and regional access roads*.

The "Walk and Talk" program provided detailed information on such issues as farm operators, family structure, uses of property, geologic and biological features, water use and the social and economic characteristics of the community. It also gave residents an opportunity to express their concerns and reactions to the proposed OWMC facility. The information obtained through the "Walk and Talk" program provided the data for many factors in Phase 4A.

The analysis of existing conditions also included an extensive series of contacts with federal, provincial and municipal agencies. Each of these contacts is listed and described in the reports of the individual site selection consultants.

2.2 SITING OPTION LF-4N/PI-1N

2.2.1 LOCATION

Siting option LF-4N/PI-1N is located in the Regional Municipality of Halton. This siting option is comprised of two sites. LF-4N contains the landfill component of the facilities. PI-1N contains the physical/chemical treatment plant and incineration plant.

Site LF-4N is located on Lots 6 and 7, Concession 7, Town of Milton. It is located approximately 4 km south of urban Milton. It is approximately 168 hectares in size. The site is bounded by Bell School Line on the southwest, Britannia Road to the southeast and Tremaine Road to the northeast. The northwestern property boundary is approximately 1.3 km northwest of and parallel to Britannia Road.

Site PI-1N is located on Lots 3 and 4, Concession 2, Town of Milton. It is located approximately 5 km south of urban Milton. It is approximately 175 ha in size. The site is bounded by Bronte Road (Highway 25) to the northeast and First Line Road to the southwest. The southeastern boundary of the site follows the line between Lots 2 and 3, Concession 2 and is approximately 1.8 km southeast of and parallel to Britannia Road. The northeastern boundary of the site follows the line between Lots 4 and 5, Concession 2 and is approximately 0.6 km southeast of and parallel to Britannia Road.

The preferred access route from Highway 401 to LF-4N is south on Fourth Line Road and west on Britannia Road. The preferred access route from the Queen Elizabeth Way to LF-4N is north on Highway 25 and west on Britannia Road.

The preferred access route from Highway 401 to PI-1N is south on Fourth Line Road and west on Britannia Road. From the Queen Elizabeth Way to PI-1N the preferred access is north on Bronte Road (Highway 25).

The intersite transfer route between PI-1N and LF-4N is north on First Line Road and west on Britannia Road.

The following subsections describe the existing conditions for this siting option, organized by risk pathway and study area. Major features are illustrated on Map 1.

2.2.2 RISK PATHWAYS

Transportation

Siting option LF-4N/PI-1N is located close to the major sources of special wastes. It is also close to 400-series highways (Queen Elizabeth Way and 401). The local and regional access routes primarily pass agricultural lands. Considerable farm traffic is experienced.

LF-4N/PI-1N has the fourth highest number of residents living adjacent to the preferred access routes (435) and the fourth highest number of residents within the access road vicinity (295).

Air Quality/Air Dispersion

A break in the Niagara Escarpment between Rattlesnake Point and Mount Nemo could cause wind channelling at both LF-4N and PI-1N. Possible increased levels of turbulence in the wake of the Escarpment are also possible at both LF-4N and PI-1N. Sixteen Mile Creek runs east-west, just north of PI-1N, in a depression of approximately 20 m. The existing and anticipated air quality in the area is good.

Hydrogeologic Suitability

The confining layer is uniform and laterally and vertically continuous. It is, however, thin at both sites.

The aquifer at LF-4N is used for domestic and agricultural purposes and may be able to meet more demanding water use requirements. The aquifer associated with PI-1N is used for domestic and agricultural purposes.

Surface Water Suitability

Site PI-1N is characterized by moderate topographic relief. It is fairly well drained. A well-defined swale drains the eastern half of the site, eventually to Sixteen Mile Creek. A poorly-defined swale drains the western half of the site, eventually to Bronte Creek. The watershed divide for Bronte Creek and Sixteen Mile Creek runs through the middle of the site, in an approximate northeast - southwest direction. No part of the site is located on designated floodplain. No surface water withdrawal for domestic or potable supplies was identified.

Site LF-4N is characterized by fairly flat relief. It is only moderately well drained. It has a permanent wetland on-site. There are no significant watercourses on-site. Two minor swales drain the site to the south. Two swales drain the site to the west. All swales drain into Indian Creek and eventually to Bronte Creek. There are designated floodplains (Indian Creek Regional Storm Floodplain) within the extreme northwest and southwest corners of the site. Local water use is relatively minor. No surface water withdrawal for potable supplies has been identified.

The total Stream Crossing Distances (SCD) for the access routes to this siting option range from 400 to 3,485 m for PI-1N and from 400 to 3,985 m for LF-4N. The total Downstream Surface Water Use Indices (DSWUI) range from 87.4 to 338.0 for PI-1N and from 87.4 to 350.9 for LF-4N.

The access routes to this option cross many streams, including major crossings at Sixteen Mile Creek and Bronte Creek.

2.2.3 STUDY AREAS

Site

Site LF-4N is currently used for rural and agricultural purposes. There are six residences on-site. The existing use on site PI-1N is predominantly rural with five residences.

PI-1N is designated for Agriculture. LF-4N is designated for Agriculture and Waste Disposal. PI-1N is zoned for Agricultural uses. LF-4N is zoned for Sanitary Waste Disposal, Agricultural and Conservation uses.

Additional site features are identified in Tables 2.1, 2.2 and 2.3.

TABLE 2.1

Social, Economic and Land Use Features - Site

- 34 people reside on the siting option
- 2 archaeological sites and 1 historic site on LF-4N
- 10 archaeological sites on PI-1N
- 5 businesses, 14 employees
- 2 community and recreation features

TABLE 2.2[1]

Agricultural Features - Site

- 2 owned farm headquarters
- 80% of site is farmed
- average size of on-site farm operations is 12 ha
- 264 ha of Class 1 equivalent soils
- gross farm revenue was $77,000 in 1984

TABLE 2.3

Biological Features - Site

- 14 rare plants
- 67 ha of natural vegetation displaced
- low potential for identifying other significant features

Site Vicinity*

The site vicinities of LF-4N and PI-1N are predominantly rural. There are approximately 130 residences, six commercial uses and a light industrial use within the site vicinity of LF-4N. There are over 100 residences, six commercial uses and one industrial use within the site vicinity of PI-1N.

The predominant land use designation in the vicinity of LF-4N is Agriculture. Other designations in the site vicinity of LF-4N include Niagara Escarpment Plan and Conservation and Hazard Lands. The predominant official plan designations in the vicinity of PI-1N are Agriculture and Parkway Belt West. The rural settlement of Boyne abuts PI-1N.

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[1] All agricultural data given in this chapter are based on the assumption that PI-27E is non-agricultural by virtue of its official plan designation.

Approximately 15% of the land in the site vicinity of LF-4N is designated for Complimentary Open Space uses and as Scarp Protection Areas under the Niagara Escarpment Plan. There are also lands in the vicinity of PI-1N designated for Public and Open Space uses under the Parkway Belt West Plan.

Tables 2.4, 2.5 and 2.6 identify additional site vicinity features.

TABLE 2.4
Social, Economic, Land Use Features - Site Vicinity

- 88 residents adjacent, 23 spend majority of time at home
- 759 people live in the site vicinity
- 55 residents live within the 55 dBA noise impact zone, 9 spend majority of time at home
- 15 residents within 50 dBA noise impact zone
- 43 dwellings within visual foreground (0 - 0.8 km)
- 131 dwellings within visual middleground (0.8 - 2.0 km)
- 1 community and recreation feature adjacent and within the noise impact zone
- 16 community and recreation features within the site vicinity
- 22 businesses, employing 286 people

TABLE 2.5

Agricultural Features - Site Vicinity

- 21 farms with headquarters, 5 adjacent
- 5 farms would lose an average of 50 ha of on-site rented land (15% of their operating land base)
- 8 farm operators own farmland adjacent
- livestock densities in adjacent vicinity and non-adjacent vicinity are 0.40/ha and 0.45/ha

TABLE 2.6

Biological Features - Site Vicinity

- 140 ha of SEU
- 245 ha of other natural vegetation
- 1 significant fish and wildlife feature - waterfowl staging area
- 8 rare plants
- 3 rare animals

Community and Regional

The general character of the area is, and is expected to remain, a mix of rural, residential and agricultural uses. Milton experienced relatively rapid population growth between 1971 and 1981 (IER, 1985a, p.167). This pattern is reflected in a relatively low social stability index[1]. There are no existing or designated industrial land uses within 2 km of the siting option. Only 1% of the designated land use within 5 km of LF-4N/PI-1N is industrial.

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[1] Social stability is a measure of a community's propensity to change and/or to maintain social continuity. A social stability index was calculated for each siting option (IER, 1985b, p.A.13).

Other community and regional features are identified in Tables 2.7 and 2.8.

TABLE 2.7

Social, Economic, Land Use Features - Community and Regional

- 1 potential tourism-related facility within 2 km of LF-4N
- 1 potential tourism-related facility just outside of 2 km of LF-4N
- existing land uses largely rural, some residential in urban Milton
- rural settlements of Omagh, Lowville and Boyne
- designations include Agricultural, Parkway Belt, Niagara Escarpment and residential communities and industrial lands in urban Milton

TABLE 2.8

Agricultural Features - Community and Regional

- 56% of farmers are full-time farmers with no off-farm employment
- 62% under the age of 55 years
- 89% of land is farmed, 32% by the owner, 68% rented
- majority in large parcels
- many small parcels created for residential and hobby farm purposes
- 66% residences are non-farm
- $6.4 million gross farm revenue in 1981

Access Roads

LF-4N/PI-1N has the fourth highest number of residents living adjacent to the access route (435) and the fourth highest number of residents within the access road vicinity (295). There are 16 community and recreation features adjacent to the access route and 12 features within the access route vicinity.

Agricultural uses along the preferred access routes include cash crops, beef, dairy and horse farms. The route is also used extensively for the movement of farm equipment.

Access road features are identified in Tables 2.9 and 2.10.

TABLE 2.9

Social, Economic, Land Use Features - Access Roads

- 435 residents adjacent
- 295 additional residents in the vicinity
- 358 residents within the noise impact zone
- 16 community and recreation features - adjacent
- 12 community and recreation features in the vicinity
- 20 community and recreation features in the noise impact zone
- 227 residences
- 18 commercial uses
- 1 industrial use
- designations predominantly Parkway Belt with Open Space/Hazard Lands and Agricultural

TABLE 2.10

Agricultural Features - Access Roads

- passes 2,600 ha of cropped land
- passes 890 animal units of livestock

2.3 SITING OPTION LF-4N/PI-13N

2.3.1 LOCATION

Siting option LF-4N/PI-13N is located in the Regional Municipality of Halton. This siting option is comprised of two sites. LF-4N contains the landfill component of the facilities. PI-13N contains the physical/chemical treatment plant and incineration plant.

Site LF-4N is located on Lot 6 and Lot 7, Concession 7, Town of Milton. It is located approximately 4 km south of urban Milton. It is approximately 168 hectares in size. The site is bounded by Bell School Line on the southwest, Britannia Road to the southeast and Tremaine Road to the northeast. The northwestern property boundary is approximately 1.3 km northwest of and parallel to Britannia Road.

Site PI-13N is located on Lot 3 and Lot 4, Concession 6, Town of Milton. It is located 6 km east of urban Milton. The site is approximately 170 hectares in size. It is bounded by Fifth Line Road to the southwest and Sixth Line Road to the northeast. The northwestern boundary of the site is approximately 0.7 km south of and parallel to Britannia Road. The southeastern boundary is approximately 1.9 km south of and parallel to Britannia Road.

The preferred access route from Highway 401 to LF-4N is south on Fourth Line Road and west on Britannia Road. The preferred access route from the Queen Elizabeth Way to LF-4N is north on Highway 25 and west on Britannia Road.

The preferred access route from Highway 401 to PI-13N is south on Fourth Line Road and east on Britannia Road and south on Fifth Line Road. From the Queen Elizabeth Way, the preferred access route to PI-13N is north on Highway 25, east on Britannia Road and south on Fifth Line Road.

The intersite transfer route between PI-13N and LF-4N is north on Fifth Line Road and west on Britannia Road.

The description of the existing conditions for this siting option is organized by risk pathway and study area. Major features are illustrated on Map 2.

2.3.2 RISK PATHWAYS

Transportation

Siting option LF-4N/PI-13N is located closest to the major sources of special wastes. It is also located close to 400-series highways (Queen Elizabeth Way and 401). The local and regional access routes primarily pass agricultural lands. Considerable farm traffic is experienced.

LF-4N/PI-13N has the third largest number of residents living adjacent to the preferred access routes (481) and the third largest number of residents within the access road vicinity (347).

Air Quality/Air Dispersion

A break in the Niagara Escarpment between Rattlesnake Point and Mount Nemo could cause wind channelling at LF-4N, and to a lesser degree at PI-13N.

Increased levels of turbulence as a result of wind channeling in the wake of the escarpment are possible at LF-4N. Sixteen Mile Creek is approximately 0.8 to 2.0 km to the east and south of PI-13N, in a depression of approximately 25 m. The existing and anticipated air quality in the area is good.

Hydrogeologic Suitability

The confining layer at LF-4N is uniform and laterally and vertically continuous but thin. The confining layer at PI-13N is thin and displays some local variability. The aquifer associated with PI-13N is used for domestic and agricultural purposes.

Surface Water Suitability

LF-4N is characterized by fairly flat relief. It is only moderately well drained with a permanent wetland on-site. There are no significant watercourses on-site. Two minor swales convey flow from the site to the south. Two swales convey flow to the west. All swales drain into Indian Creek and eventually to Bronte Creek. There are designated floodplains (Indian Creek Regional Storm Floodplain) within the extreme northwest and southwest corners of the site. Local water use is relatively minor. No surface water withdrawal for potable supplies was identified.

PI-13N is characterized by good topographic relief. It is generally well drained. Shallow field swales drain the western portion of the site, southwest to a well-defined tributary of Sixteen Mile Creek. Shallow field swales also drain the eastern half of the site, southeast to the East Sixteen Mile Creek (East Oakville Creek). Local water use is high. Two potable and two non-potable domestic water supplies were identified downstream. Other uses include livestock watering and irrigation.

The total Stream Crossing Distances (SCD) range from 1,325 to 5,170 m for PI-13N and from 400 to 3,985 m for LF-4N for the access routes to this siting option. The total Downstream Surface Water Use Indices (DSWUI) range from 250.1 to 328.9 for PI-13N and from 87.4 to 350.9 for LF-4N.

There are some major access route stream crossings. They include Sixteen Mile Creek.

2.3.3 STUDY AREAS

Site

LF-4N is currently used for rural and agricultural purposes. There are six residences on-site. Agriculture is the existing land use on PI-13N. Four residences are located on-site at PI-13N.

LF-4N is designated for Agriculture and Waste Disposal. The site is zoned for Sanitary Waste Disposal, Agricultural and Conservation Uses. Site PI-13N is designated almost entirely for Agriculture. The balance of the site is designated Conservation and Hazard Lands. The site is zoned Agricultural.

Farmland sales in the Milton area have declined slightly over the 1980 to 1983 period. Absentee-ownership is high on LF-4N. PI-13N is almost entirely owned by the Ontario Land Corporation.

Additional site features are identified in Tables 2.11, 2.12 and 2.13.

TABLE 2.11

Social, Economic, Land Use Features - Site

- 31 people
- 1 historic building
- proposed Glenorchy Conservation Area
- 2 archaeological sites and 1 historic site on LF-4N
- 2 archaeological sites and 1 historic site on PI-13N
- 3 businesses, 8 employees

TABLE 2.12

Agricultural Features - Site

- 4 farm headquarters
- 82% of land is farmed
- gross farm revenue of $177,300 in 1984
- 261 ha of Class 1 equivalent
- average farm size is 12 ha

TABLE 2.13

Biological Features - Site

- 13 rare plants, 3 rare animals
- 59 ha of natural vegetation displaced
- low potential for finding other significant features

Site Vicinity

The vicinity of LF-4N is predominantly rural. Approximately 130 residences, six commercial uses and a light industrial use are located in the site vicinity of LF-4N. Existing land use in the vicinity of PI-13N is also predominantly rural. Approximately 170 residences and 14 commercial uses are located in the vicinity of PI-13N.

Agriculture is the predominant official plan designation in the vicinities of both LF-4N and PI-13N. Niagara Escarpment and Conservation and Hazard Land designations are also found in the vicinity of LF-4N. Other designations in the vicinity of PI-13N include Parkway Belt and Conservation and Hazard Lands. The rural settlements of Drumquin and Omagh are also within the vicinity of PI-13N.

Additional features found in the site vicinity are identified in Tables 2.14, 2.15 and 2.16.

TABLE 2.14
Social, Economic, Land Use Features - Site Vicinity

- 95 residents adjacent, 28 spend most of their time at home
- 959 residents live in the vicinity
- 55 residents within the 55 dBA noise impact zone, 9 spend most of their time at home
- 6 residents within 50 dBA noise impact zone
- 54 residences within visual foreground (0 - 0.8 km)
- 123 residences within visual middleground (0.8 - 2.0 km)
- 2 community and recreation features adjacent, 1 in the noise impact zone
- 16 community and recreation features in the vicinity
- 23 businesses, employing 344 people

TABLE 2.15

Agricultural Features - Site Vicinity

- 27 farms with headquarters, 8 adjacent
- 97% of land used for agricultural purposes
- 11 farm operators own land adjacent, 1 would lose 79 ha (15% of total land base)
- livestock density is 0.54/ha in the adjacent vicinity and 0.28/ha in the non-adjacent vicinity

TABLE 2.16

Biological Features - Site Vicinity

- 94 ha of SEU
- 291 ha of other natural vegetation
- 1 significant fish and wildlife feature - waterfowl staging area
- 7 rare plant species, 6 rare animal species

Community and Regional

Milton experienced rapid population growth between 1971 and 1981 (IER, 1985a, p.167). This pattern is reflected in a relatively low social stability index. The general character of the area is rural residential and agricultural. The existing and designated land uses within 2 km and 5 km of the siting option are almost all non-industrial.

No potential tourism-related facilities were identified within 2 km of PI-13N. One potential tourism-related facility was identified within 2 km of LF-4N. In addition, a second tourism-related facility was identified on the Niagara Escarpment, just outside the site vicinity study area.

Existing land uses in the community and regional area are largely rural. However, a large part of the residential area in southern urban Milton and the settlements of Lowville, Boyne, Drumquin and Omagh are within the community and regional area.

Proposed and planned land uses in the community and regional area include residential communities in the urban area of Milton, some industrial lands in Milton and the minor rural settlements of Lowville and Boyne. The major land use designations in the community and regional study area include Agriculture, Parkway Belt, Conservation and Hazard Lands and Niagara Escarpment uses. Table 2.17 identifies social, economic and land use features in the community and regional study area.

Farmland represents 84% of the land in the area. Twenty-six percent of this land is farmed by the landowner and the remaining 74% is farmed on a rental basis. Table 2.18 identifies additional agricultural features in the community and regional study area.

TABLE 2.17
Social, Economic, Land Use Features - Community and Regional

- 1 potential tourism - related facility within 2 km of LF-4N
- 1 potential tourism - related facility just outside of 2 km of LF-4N
- existing land uses largely rural, some residential in urban Milton
- rural settlements of Omagh, Lowville and Boyne
- designations include Residential, Industrial, Rural/Vacant, Agricultural Conservation and Hazard Lands, Parkway Belt and residential communities and industrial lands in urban Milton

TABLE 2.18

Agricultural Features - Community and Regional

- 77% of the respondents considered themselves full-time farmers
- 58% of the respondents were below the age of 55
- 85% of land is farmed - 26% is farmed by the owner, 74% rented
- many large land parcels, but very large proportion are tenant farmed
- 72% of residences are non-farm
- gross farm revenue in 1981 $16.3 million

Access Roads

LF-4N/PI-13N has the third largest number of residents living adjacent to the preferred access route (481) and the third largest number of residents within the access road vicinity (347). There are 16 community and recreation features adjacent to the access route and 15 features within the access route vicinity.

The access routes to this siting option pass a total of 3,540 hectares of cropped land and 1,340 animal units of livestock. Agricultural uses along the route include cash crops, beef, dairy and horse farms. The route is used extensively for movement of farm equipment.

Additional features along the access routes to this siting option are described in Tables 2.19 and 2.20.

TABLE 2.19

Social, Economic, Land Use Features - Access Roads

- 481 residents adjacent, an additional 347 residents in vicinity
- 370 people within noise impact zone
- 20 community and recreation features within noise impact zone
- 16 community and recreation features adjacent, additional 15 in vicinity
- 254 residences
- 18 commercial uses
- 1 industrial use

TABLE 2.20

Agricultural Features - Access Roads

- passes 3,540 ha of cropped land
- passes 1,340 animal units of livestock

2.4 SITING OPTION LF-3C

2.4.1 LOCATION

Siting option LF-3C is located on part of Lot 5, Lot 6, and part of Lot 7, Concession 1 and part of Lot 7, Broken Front Concession, Township of West Lincoln, Regional Municipality of Niagara. The site is approximately 206 hectares in size. It is located approximately 5 km southwest of Bismarck and 5 km west of Wellandport.

The site is bounded by Zumstein Road and property boundaries to the south, Elcho Road, property boundaries and Beaver Creek to the north and Vaughan Road to the west. The east boundary follows property boundaries. It is parallel to and approximately 1.8 km east of Vaughan Road.

LF-3C is an integrated siting option with all three facility components - incineration plant, physical/chemical treatment plant and engineered landfill - located on-site.

The preferred access route to this siting option is south on Regional Road 24 from the Queen Elizabeth Way to Highway 20, west on Highway 20 to Regional Road 65, west on Regional Road 65 to Krick Road and south on Krick Road to the siting option.

The description of the existing conditions for this siting option is organized by risk pathway and study area. Major features are illustrated on Map 3.

2.4.2 RISK PATHWAYS

Transportation

Siting option LF-3C is farther from the existing 400-series highways (Queen Elizabeth Way) than the other siting options. It is also more remote from the major sources of special wastes. The local and regional access roads pass many residential areas, community and recreation features and major watercourses. They are also characterized by high traffic volumes including farm equipment and school bus movements. LF-3C has the largest number of residents living adjacent to the preferred access route (993) and the largest number of residents within the access road vicinity (1,794).

Air Dispersion/Air Quality

Siting option LF-3C does not have any air dispersion constraints. The existing and anticipated air quality in the area is good.

Hydrogeologic Suitability

The confining layer is thick, uniform and laterally and vertically continuous at LF-3C. The underlying aquifer is used for domestic and agricultural purposes. The aquifer is not expected to meet more demanding water use requirements because of water quality concerns.

Surface Water Suitability

Siting option LF-3C is characterized by poor topographic relief. It is also generally poorly drained. The Welland River floodplain extends to the southern site boundary and through the northern portion of the site along Beaver Creek. Shallow swales drain the southern portion of the site, southeastward to an unnamed tributary of the Welland River.

Stream water and ponds are used frequently in the site vicinity for livestock watering, for domestic use and recreation.

The Stream Crossing Distance (SCD) for the access route to this siting option is 6,115 m. The Downstream Surface Water Use Index (DSWUI) is 936.8. Four major watercourses (Fifteen Mile Creek, Sixteen Mile Creek, Twenty Mile Creek and Beaver Creek) are crossed by the access route to this option.

2.4.3 STUDY AREAS

Site

The existing use of LF-3C is predominantly rural or vacant. There are four residences on-site. This siting option is designated for Rural and Hazard Land uses in the Township of West Lincoln Official Plan. The site is zoned Agricultural.

Farmland sales in West Lincoln have increased 28% over the 1980 to 1983 period. Absentee-ownership of the site is very low.

Additional site features are highlighted in Tables 2.21, 2.22 and 2.23.

TABLE 2.21

Social, Economic, Land Use Features - Site

- 29 people
- 1 archaeological site
- 1 historic site

TABLE 2.22

Agricultural Features - Site

- 2 farm headquarters
- 135 ha of Class 1 equivalents
- 145 ha of land cropped in 1984
- gross farm revenue $156,000 in 1984
- 65 ha average farm size
- 57 ha tile drained

TABLE 2.23

Biological Features - Site

- 4 rare plant species, 1 rare animal species
- 75 ha of natural vegetation displaced
- moderate to high potential for occurrence of significant features

Site Vicinity

The existing uses in the site vicinity of LF-3C are predominantly rural. There are also 177 residences, four commercial uses and the rural settlement of Oswego Park in the site vicinity. The predominant land use designations in the vicinity of LF-3C are Rural and Hazard Land Uses. The site vicinity also includes a Rural Residential (Hamlet) Designation (Oswego Park).

Additional site vicinity features are listed in Tables 2.24, 2.25 and 2.26.

TABLE 2.24

Social, Economic, Land Use Features - Site Vicinity

- 48 people live adjacent, 23 spend most of their time at home
- 765 people live within the vicinity
- 34 residents in 55 dBA noise impact zone, 6 spend most of their time at home
- 16 homes in visual foregound (0 - 0.8 km)
- 42 homes in visual middleground (0.8 - 2.0 km)
- 6 recreation or community features in the vicinity
- 2 recreation or community features in the noise impact zone
- 10 businesses, 79 employees
- development proposals include 2 single-family homes and a new dormitory for a private school (Robert Land Academy)

TABLE 2.25

Agricultural Features - Site Vicinity

- 36 farms with headquarters, 5 adjacent
- 10 operators own land adjacent to site
- 3 operators would lose an average of 47 ha (up to 1/3 of land base)
- livestock density of 0.32/ha in adjacent vicinity and 1.09/ha in non-adjacent vicinity
- 61% of non-adjacent vicinity is in crops

TABLE 2.26

Biological Features - Site Vicinity

- 100 ha of SEU
- 298 ha of other natural vegetation
- 4 significant fish and wildlife features - 3 pike spawning areas, 1 waterfowl production area
- 17 rare plant species, 3 rare animal species

Community and Regional

This area is rural agricultural in character. It is expected to change very little in the future. Dairy farming is an important component of the local economy. There are no existing or designated industrial land uses within 5 km of this siting option. Growth in the rural area is predicted to be slow, but stable. Relatively slow population growth occurred in West Lincoln between 1971 and 1981. This trend is reflected in a moderately high social stability index.

Community and regional features are also highlighted in Tables 2.27 and 2.28.

TABLE 2.27

Social, Economic, Land Use Features - Community and Regional

- no tourism-related facilities within 2 km
- Chippawa Creek Conservation Area, 2-3 km south-east, serves primarily local and regional market
- existing land uses largely rural, include all or part of 5 rural settlements: Wellandport, Bismarck, Winslow, Attercliffe and Moulton
- planned and proposed land uses are largely Rural designations, except for 5 hamlets

TABLE 2.28

Agricultural Features - Community and Regional

- 75% of farmers interviewed below age 55
- 52% of farmers interviewed classified themselves as full-time farmers with no off-farm employment
- 91% land in the local community area is farmed, 74% by the owners
- 64% non-farm residences
- 98% in private land ownership
- 82% in large parcels
- $6.9 million in gross farm revenue in 1981

Access Roads

LF-3C has the largest number of residents living adjacent to the preferred access route (993) and the largest number of residents within the access route vicinity (1,794). This siting option also has the largest number of community and recreation features adjacent to the preferred access route (18) and the second largest number of features in the access route vicinity (13).

Agriculture along the route ranges from orchards and vineyards along the northern half of Vineland Road, to a mix of cash crops along Highway 20. Along Regional Road 65 and Krick Road, the route passes mainly dairy and poultry farms. The roads are used extensively for farm traffic. The access route to this option passes 3,600 hectares of cropped land and 7,840 livestock. An estimated 517 cattle crossings are located on the local roads.

Additional access road features are listed in Tables 2.29 and 2.30.

TABLE 2.29
Social, Economic, Land Use Features - Access Road

- 993 people live adjacent
- 1,794 people live within the vicinity
- 1,170 people live within the noise impact zone
- 18 community and recreation features adjacent
- 13 community and recreation features within the vicinity
- 21 community and recreation features in the noise impact zone
- 833 residences along route
- 59 commercial facilities
- 4 industrial facilities
- designations along route predominantly Rural with Open Space and Hazard Land and Residential

TABLE 2.30

Agricultural Features - Access Road

- 3,600 ha of adjacent crops
- 7,840 adjacent animal units of livestock

2.5 SITING OPTION LF-9C

2.5.1 LOCATION

Siting Option LF-9C is located on parts of Lot 17 and 18, Concession 3, in the Township of West Lincoln in the Regional Municipality of Niagara. It is located approximately 14 km southwest of Vineland, 4 km east of Bismarck and 4 km northeast of Wellandport. The siting option is 135 hectares in size. It is bounded on the north by Highway 20, on the east by Schram Road and on the south by Vaughan Road East. The western boundary is approximately 0.9 km west of and parallel to Schram Road. LF-9C is an integrated siting option with all three facility components located on-site.

The preferred access road to LF-9C is south on Regional Road 24 from the Queen Elizabeth Way to Highway 20 and then west on Highway 20 to the siting option.

The existing conditions, organized by risk pathway and by study area, are described in the following sections. Major features are identified on Map 4.

2.5.2 RISK PATHWAYS

Transportation

Siting option LF-9C is relatively far from the existing 400-series highways (Queen Elizabeth Way). It is also relatively remote from the major sources of special wastes. The local and regional access route passes residential areas, community and recreation features and major watercourses. It also experiences high traffic volumes. It is used extensively for agricultural purposes and school bus movements.

LF-9C has the second largest number of residents living adjacent to the preferred access road (775) and the second largest number of residents in the access road vicinity (1716).

Air Dispersion/Air Quality

Siting option LF-9C does not have any air dispersion constraints. The existing and anticipated air quality in the area is good.

Hydrogeologic Suitability

The confining layer at LF-9C is thick, uniform and laterally and vertically continuous. The siting option is underlain by a potentially significant aquifer.

Surface Water Suitability

The site is generally poorly drained and is characterized by poor topographic relief. No part of the site is on designated floodplain land. A minor swale drains a majority of the site, south to the Welland River. The southwest corner of the site is drained by another small tributary of Welland River. The northeast corner of the site is drained by Sucker Creek.

Surface water in the site vicinity is used for livestock purposes, but not for potable or domestic supplies.

The Stream Crossing Distance (SCD) for the preferred access route to this option is 4,945 m. The Downstream Surface Water Use Index (DSWUI) for the preferred access route is 329.5. Three major watercourses (Fifteen Mile Creek, Sixteen Mile Creek and Twenty Mile Creek) and Sucker Creek are crossed by the preferred access route.

2.5.3 STUDY AREAS

Site

The existing use for LF-9C is agriculture. The site is designated Rural in the Township of West Lincoln Official Plan. It is zoned almost entirely Agricultural. Farmland sales have increased 28% in the period 1980-1983. One-half of the total area of the site (one-quarter of the properties) is under absentee ownership. Other site features are listed in Tables 2.31, 2.32 and 2.33.

TABLE 2.31

Social, Economic, Land Use Features - Site

- 9 residents
- 4 archaeological sites
- 4 historic sites

TABLE 2.32

Agricultural Features - Site

- 2 farm headquarters
- 90 ha Class 1 equivalent
- 47% (64 ha) of site farmed, additional 30% (40 ha) tillable, but idle
- gross farm revenue of $53,000 in 1984
- 19 ha tile drained
- average farm size is 37 ha

TABLE 2.33

Biological Features - Site

- 6 rare plants, 5 rare animals
- 61 ha of natural vegetation displaced
- low potential for discovery of other significant features

Site Vicinity

The predominant land use in the site vicinity of LF-9C is agriculture. There are approximately 75 residences and seven commercial uses within the site vicinity. The site vicinity is largely designated Rural. In addition, there are designations for minor commercial uses and for a proposed recreational trailer park. Tables 2.34, 2.35 and 2.36 highlight other features in the site vicinity.

TABLE 2.34

Social, Economic, Land Use Features - Site Vicinity

- 40 residents adjacent, 15 spend majority of time at home
- 272 residents in site vicinity
- 88 residents within 55 dBA noise impact zone, 25 spend majority of time at home
- 9 residents within 50 dBA noise impact zone
- 28 homes within visual foreground (0 - 0.8 km)
- 48 homes within visual middleground (0.8 - 2.0 km)
- 2 community/recreation features in the vicinity
- 9 businesses, 23 employees

TABLE 2.35

Agricultural Features - Site Vicinity

- 29 farm with headquarters, 6 adjacent to site
- 8 farm operators own land adjacent to site
- 1 adjacent farm would lose 20 ha (16% of that farm's land base) of on-site land
- livestock density is 1.14/ha in the adjacent vicinity and 2.44/ha in the non-adjacent vicinity

TABLE 2.36

Biological Features - Site Vicinity

- 145 ha of SEU
- 111 ha of other natural vegetation
- 2 significant fish and wildlife features - pike spawning areas
- 1 rare plant, 3 rare animals

Community and Regional

West Lincoln has experienced a slow population growth between 1971 and 1981. This trend is reflected in a high social stability index. The area is rural/agricultural in character. None of the existing and designated land uses within 5 km of the siting option are industrial. The general character of the area is expected to change very little. Additional community and regional features are listed in Tables 2.37 and 2.38.

TABLE 2.37

Social, Economic, Land Use Features - Community and Regional

- no significant tourism potential due to distance from major transportation routes, agricultural usage and average scenic attributes
- existing land uses are agricultural, rural or vacant
- rural settlements in Wellandport, Bismarck, Boyle and Silverdale
- proposed and planned land uses are agricultural
- Hamlet designations for Wellandport, Bismarck, Silverdale and Boyle

TABLE 2.38

Agricultural Features - Community and Regional

- 75% farm operators responding, are under 55 years of age
- 94% of local community area is farmland, 76% farmed by landowner
- high proportion of the land is in large parcels
- 42% of residences in local community are non-farm
- $8.6 million in regional gross farm revenue in 1981

Access Roads

LF-9C has the second largest number of residents living adjacent to the preferred access route (775) and the second largest number of residents within the access route vicinity (1,716). This siting option has 14 community and recreation features adjacent to the preferred access route and 11 features in the access route vicinity.

Agriculture along the preferred route ranges from orchards and vineyards along the north half of Vineland Road (Regional Road 24), to a mix of cash crop, dairy and poultry farms along the southern half and along Highway 20. The route crosses the Niagara Escarpment and passes over 2,300 hectares of cropped land and 1,700 livestock. Access route features are listed in Tables 2.39 and 2.40.

TABLE 2.39

Social, Economic, Land Use Features - Access Road

- 775 people live adjacent
- additional 1,716 residents live within the vicinity (800 metres)
- 986 people are within the noise impact zone
- 14 community and recreation features adjacent to the access route
- additional 11 community and recreation features within the vicinity
- 17 community and recreation features within noise impact zone
- existing land use predominantly vacant and rural, except Vineland urban area and small residential clusters
- 750 residences along route
- 51 commercial uses
- 4 industrial uses
- planned and proposed land uses include 75% rural, remainder open space or residential
- projected population of Vineland is 8,700
- future proposed residential uses include a 700-unit retirement village

TABLE 2.40

Agricultural Features - Access Road

- 2,360 ha of adjacent crops
- 1,730 adjacent animal units of livestock

2.6 SITING OPTION LF-1E

2.6.1 LOCATION

Siting option LF-1E is located in the Regional Municipality of Niagara. The site is approximately 273 hectares in size. It includes Lots 5, 6 and 7 on Concessions 2 and 3, City of Niagara Falls. It is located south of the Welland River.

The site is bounded by Carl Road to the north, Crowland Avenue to the east and Schisler Road to the south. The west boundary is formed by a ConRail rail line.

LF-1E is an integrated siting option with all three facility components - incineration plant, physical/chemical treatment plant and engineered landfill - located on-site.

The preferred access route to this siting option is west on Biggar Road from the Queen Elizabeth Way, south on Crowland Avenue and west on Carl Road.

A description of existing conditions, organized by risk pathway and study area is presented in the following subsections. Major features are illustrated on Map 5.

2.6.2 RISK PATHWAYS

Transportation

Siting option LF-1E is located furthest from the major sources of special wastes. The site is located very close to the freeway system. The local and regional access route passes primarily agricultural lands.

LF-1E has the second least number of residents living adjacent to the preferred access route (17) and the least number of residents within the access road vicinity (60).

Air Quality/Air Dispersion

There are moderately significant local sources of SO_2 (sulphur dioxide), NO_x (nitrogen oxide) and TSP (total suspended particulates) located in the nearby area. As a result, there is relatively poor existing air quality at this siting option. There are no significant restraints to dispersion for this siting option.

Hydrogeologic Suitability

The confining layer thins to extinction under the southeastern portion of the site, as a result of a local morainal feature. Sand layers associated with the moraine could be present within the confining layer under the site.

The aquifer associated with LF-1E is uesd for domestic and agricultural purposes and may be capable of meeting further water use requirements.

Surface Water Suitability

LF-1E is characterized by very little topographic relief. It is poorly drained. No part of the site is located on designated floodplain. All site runoff eventually drains to Lyons Creek. Local surface water use in the site vicinity is moderate. No surface water is taken for potable or domestic supply on site, in the site vicinity or downstream. Surface water uses include livestock operations and golf course irrigation.

The preferred access route to this option does not cross any streams. Therefore the Stream Crossing Distance (SCD) and the Downstream Surface Water Use Index (DSWUI) are 0.0 m and 0.0, respectively.

2.6.3 STUDY AREAS

Site

The existing use of LF-1E is predominately rural residential or vacant. There is, however, a single commercial use - an auto wrecking yard. The site is designated for Good General Agricultural uses in the draft City of Niagara and in the Region of Niagara Official Plans. The site is entirely zoned Rural Agricultural.

Additional site features are listed in Tables 2.41, 2.42 and 2.43.

TABLE 2.41

Social, Economic, Land Use Features - Site

- 43 people
- 4 archaeological sites
- 7 historic sites
- 16 residences
- 6 business, 22 employees displaced

TABLE 2.42

Agricultural Features - Site

- 7 farm headquarters
- average farm size is 27 ha
- gross farm revenue of $36,800 in 1984
- 177 ha of Class 1 equivalents

TABLE 2.43

Biological Features - Site

- 6 rare plant species, 2 rare animal species
- 118 ha of natural vegetation displaced
- high potential for occurrence of significant features

Site Vicinity

Over 200 residences and nine commercial uses are located in the vicinity of LF-1E. The existing use is still predominately rural. The rural settlement of Cook's Mills is partly within the site vicinity.

The primary designated land uses in the site vicinity of LF-1E include Good General Agricultural (over half of the land area) and Rural (quarter of the land area). Lands of lesser agricultural capability are designated Rural in the City of Niagara Falls draft Official Plan. The Rural designation is used for the protection of prime agricultural lands in the City of Welland Official Plan. Part of the Residential Neighbourhood designation for Cook's Mills, in the City of Welland Official Plan, is included in the site vicinity.

Other features of the site vicinity are listed in Tables 2.44, 2.45 and 2.46.

TABLE 2.44

Social, Economic, Land Use Feature - Site Vicinity

- 31 residents adjacent, 6 spend most of their time at home
- 737 people in vicinity
- 21 residents within 55 dBA noise impact zone, 6 spend most of their time at home
- 4 residents within 50 dBA noise impact zone
- 11 homes within visual foreground (0 - 0.8 km)
- 35 residences within visual middleground (0.8 - 2.0 km)
- 14 community and recreation features in vicinity
- 15 businesses, 53 employees

TABLE 2.45

Agricultural Features - Site Vicinity

- 23 farms with headquarters, 3 adjacent to site
- 5 operators own land adjacent
- 2 operators would lose an average of 20 ha (25% and 30% of land base)
- 75% of land is farmed, 52% by the owner, 48% by tenants
- livestock density of 0.26/ha in adjacent vicinity and 0.25/ha in the non-adjacent vicinity

TABLE 2.46

Biological Features - Site Vicinity

- 386 ha of SEU
- 333 ha of other natural vegetation
- 2 significant fish and wildlife features - pike spawning areas
- 3 rare plant species, 6 rare animal species

Community and Regional

The immediate area of LF-1E is largely agricultural, with some rural residential land uses. No existing land uses within 2 km are industrial. Two percent of the land within 2 km is intended for industrial development. Six percent of the land uses within 5 km of the site are industrial. Fourteen percent of the land within 5 km of the site is designated for industrial uses.

Slow population growth in Niagara Falls, between 1971 and 1981, is reflected in a high social stability index. The distance from the urban area and encroaching non-rural land uses of Niagara Falls will likely help to retain the area's agricultural character, at least over the short-term.

Additional community and regional features are noted in Tables 2.47 and 2.48

TABLE 2.47

Social, Economic, Land Use Features
- Community and Regional

- existing land uses largely rural or vacant, but includes Cook's Mills and industrial uses on either side of the Welland River
- proposed and planned land uses include designations for Good General Agricultural, Rural, Residential Neighbourhood, Industrial (on either side of the Welland River) and Resort and Highway Commercial east of the Queen Elizabeth Way

TABLE 2.48

Agricultural Features
- Community and Regional

- 65% of farm respondents under age of 55
- 16% of respondents full-time farmers
- 62% of land is farmed, 39% by the landowners
- 83% of residences are non-farm
- gross farm revenue of $2.0 million in 1981

Access Roads

LF-1E has the second lowest number of residents living adjacent to the preferred access route (17) and the least number of residents within the access road vicinity (60). There is only one community and recreation feature adjacent to the access route and two features within the access route vicinity.

Agriculture along the route is mainly cash-cropping. Extensive use of Crowland Avenue is made by local farmers for equipment movement. Three hundred and forty hectares of cropland and approximately 50 livestock units are passed by the route.

Additional access route features are noted in Tables 2.49 and 2.50.

TABLE 2.49
Social, Economic, Land Use Features - Access Road

- 17 people live adjacent
- 60 people live in the vicinity
- 17 people in noise impact zone
- 1 community and recreation feature adjacent to the route and within the noise impact zone
- 2 community and recreation features in the vicinity
- 27 residences
- 1 commercial facility
- land use designations primarily Agricultural, with Open Space/Hazard Land and Industrial

TABLE 2.50
Agricultural Features - Access Road

- 340 ha of adjacent crops
- 50 adjacent animal units of livestock

2.7 SITING OPTION LF-1E/PI-27E

2.7.1 LOCATION

Siting option LF-1E/PI-27E is located in the Regional Municipality of Niagara. This option is comprised of two sites. LF-1E contains the engineered landfill component of the facilities. PI-27E contains the physical/chemical treatment plant and incineration plant components.

LF-1E is approximately 135 hectares in size. It is located on Lots 5, 6 and 7, Concessions 2 and part of Lot 6, Concession 3, in the City of Niagara Falls. The site is bounded by Carl Road to the north, Crowland Avenue to the east and Young Road and property boundaries to the south. The west boundary is formed by a ConRail rail line.

PI-27E is approximately 188 hectares in size. It is located on part of Lots 1, 2, 3 and 4, Broken Front Concession Welland River, City of Niagara Falls. The site is bounded by Crowland Avenue to the west, Grassy Brook Road to the north, Montrose Road to the east and Biggar Road to the south.

The preferred access route to PI-27E from the Queen Elizabeth Way is west on Biggar Road. The intersite transfer route between PI-27E and LF-1E is west on Biggar Road, south on Crowland Road and west on Carl Road.

The existing conditions for this siting option, organized by risk pathway and study area, are described in the following sections. Major features are illustrated on Map 6.

2.7.2 RISK PATHWAYS

Transportation

Siting option LF-1E/PI-27E is located furthest from the major sources of special wastes. The distance on local and regional roads is short due to the proximity of the siting option to the freeway system.

LF-1E/PI-27E has the smallest number of residents living adjacent to the preferred access routes (9) and the least number of residents within the access road vicinity (6).

Air Quality/Air Dispersion

Significant local sources of SO_2, NO_x and TSP are located in the nearby area. As a result, existing air quality in the area is moderately poor. No significant restraints to dispersion have been identified for this siting option.

Hydrogeologic Suitability

The confining layer at LF-1E thins to extinction under the southeastern portion of the site as a result of a local morainal feature. Sand layers associated with the moraine could be present within the confining layer under the site.

At PI-27E, the thickness of the confining layer varies as a result of buried sand deposits. The buried sand is present mainly under the northwestern portion of the site. Thin sand lenses, which appear to be more limited in extent, are also found within the central portion of the site. The confining layer appears to be more uniform to the southeast.

Domestic and agricultural ground water supplies are developed in the Guelph Formation or shallow granular aquifers at both sites. The Guelph Formation aquifer may be capable of meeting more demanding water use requirements.

Surface Water Suitability

LF-1E is characterized by very little topographic relief. The site is poorly drained. PI-27E is characterized by poor topographic relief. It is also generally poorly drained. No part of the siting option is located on designated floodplain. Both the Welland River and Lyons Creek floodplains extend to the eastern site boundary of PI-27E.

All site runoff on LF-1E eventually drains to Lyons Creek. Two well-defined, intermittent creeks traverse PI-27E in a west to east direction. The northernmost channel (Grassy Brook) drains to the Welland River. The southernmost channel (unnamed) drains to Lyons Creek.

Local surface water use in the vicinity of LF-1E and PI-27E is considered moderate and low, respectively. No surface water is taken for potable or domestic surface water supply on-site, in the site vicinity or downstream. Surface water uses include livestock operations and golf course irrigation.

The preferred access routes to this option do not cross any streams. Therefore the Stream Crossing Distance (SCD) and Downstream Surface Water Use Index (DSWUI) are 0.0 m and 0.0, respectively.

2.7.3 STUDY AREAS

Site

The existing use of LF-1E is predominantly rural, residential or vacant, except for a single commercial use. The existing use of PI-27E is primarily agricultural or vacant. The site does, however, include six residences and one industrial warehouse of approximately 28,000 m^2 in size. LF-1E is designated for Good General Agricultural uses in the draft City of Niagara and in the Region of Niagara Official Plans. It is zoned Agricultural. PI-27E is designated for Industrial uses in the draft City of Niagara Official Plan. It is also within the Urban Area designation for the City in the Niagara Region Official Plan. It is zoned Agricultural, with a provision which permits industrial uses.

Additional site features are detailed in Tables 2.51, 2.52 and 2.53.

TABLE 2.51

Social, Economic, Land Use Features - Site

- 42 residents
- 12 archaeological sites
- 12 historic sites
- 15 residences
- 1 commercial use - 1 industrial use
- moderate absentee ownership
- 7 businesses, 33 employees

TABLE 2.52

Agricultural Features - Site

- 5 farm headquarters
- average farm size is 22 ha
- gross farm revenue of $26,000 in 1984
- 91 ha of Class 1 equivalents
- 85% of on-site lands are farmed

TABLE 2.53

Biological Features - Site

- 8 rare plant species - 2 species occur on both sites, 1 rare animal species
- 83 ha of natural vegetation displaced
- high potential for occurrence of additional significant features

Site Vicinity

The predominant existing use of the site vicinity of LF-1E is rural. Over 200 residences and nine commercial uses are located in the site vicinity of LF-1E. The rural settlement of Cook's Mills is partly within the vicinity of LF-1E. The existing use of the vicinity of PI-27E is also largely rural. There are also major industrial uses, including the Ford Glass plant and Cyanamid, to the north and west, respectively. There are approximately 90 residences, eight commercial uses and 11 industrial facilities located within the site vicinity of PI-27E.

The major designated land uses in the vicinity of LF-1E include Good General Agricultural (over 1/2 of the land area) and Rural (1/4 of the land area). The Rural designation is used for lands of lesser agricultural capability in the City of Niagara Falls' draft Official Plan. It is used for the protection of prime agricultural lands in the City of Welland

Official Plan. Part of the Residential Neighbourhood designation for Cook's Mills, in the City of Welland Official Plan, is included in the site vicinity.

The vicinity of PI-27E is a mixture of Good General Agricultural, Industrial, Rural, Open Space and Highway Commercial designations.

Additional site vicinity features are noted in Tables 2.54, 2.55 and 2.56.

TABLE 2.54
Social, Economic, Land Use Features - Site Vicinity

- 42 residents adjacent, 11 spend most of their time at home
- 850 people live in the vicinity
- 37 residents live within the daytime noise impact zone, 9 spend most of their time at home
- 7 people live within the nighttime noise impact zone
- 15 homes within the visual foreground (0 - 0.8 km)
- 37 homes within the visual middleground (0.8 - 2.0 km)
- 2 community and recreation features adjacent
- 1 community and recreation feature within the noise impact zone
- 20 community and recreation features in the site vicinity
- 36 businesses, 1,594 employees

TABLE 2.55

Agricultural Features - Site Vicinity

- 27 farms with headquarters, 4 adjacent
- 7 operators own land adjacent
- 2 farms would lose an average of 13 ha of on-site land (up to 25% of their operating land base)
- 60% of the land in the vicinity is farmed, 27% by the owner
- livestock densities are 0.27/ha in the adjacent vicinity and 0.25/ha in the non-adjacent vicinity

TABLE 2.56

Biological Features - Site Vicinity

- 636 ha of SEU
- 692 ha of other natural vegetation
- 4 significant fish and wildlife features - 3 pike spawning areas, 1 waterfowl production area
- 5 rare plant species, 10 rare animal species

Community and Regional

The immediate area of the siting option is characterized by a mix of agricultural, rural residential and industrial land uses. Twenty-three percent of the land use is designated for industrial use within the 2 km study area. Within 5 km of the siting option, 4% of the existing land uses are Industrial and 10% are designated Industrial. Slow population growth in Niagara Falls, between 1971 and 1981, is reflected in a relatively high stability index.

Community and regional features are also detailed in Tables 2.57 and 2.58.

TABLE 2.57

Social, Economic, Land Use Features - Community and Regional

- the existing land uses are largely rural or vacant, but includes Cook's Mills, industrial uses on either side of the Welland River to the north, northwest and northeast and urban residential development to the north in the City of Niagara Falls
- proposed and planned land uses include designations for Good General Agricultural, Rural, Residential Neighbourhood, Industrial, Resort and Highway Commercial and parts of two residential districts within the southern section of the City of Niagara Falls, with a combined population capacity of over 10,000 persons

TABLE 2.58

Agricultural Features - Community and Regional

- 64% of the respondents under the age of 55
- 20% of the respondents are full-time farmers with no off-farm employment
- 18% of the respondents are full-time farmers, with full-time off-farm employment
- 51% of the land farmed, 27% by the owner
- 85% of residences are non-farm
- gross farm revenue of $2.5 million in 1981
- many small land parcels

Access Roads

Access road features are noted in Tables 2.59 and 2.60. The distance on local and regional roads is short due to the proximity of the siting option to the freeway system. As a result, there are few residents and community and recreation features associated with the preferred access routes.

TABLE 2.59
Social, Economic, Land Use Features - Access Roads

- 9 people live adjacent
- 60 people live within the vicinity
- 6 people live within the noise impact zone
- 1 community and recreation feature is located adjacent and within the noise impact zone
- 2 community and recreation features are within the vicinity
- 25 residences
- 1 commercial facility
- land use designations primarily Agricultural with some Industrial and Open Space/Hazard Land

TABLE 2.60
Agricultural Features - Access Roads

- 400 ha of adjacent crops
- 0 adjacent animal units of livestock

3.0 DESIGN MODIFICATIONS

3.1 INTRODUCTION

As described in the Phase 4A engineering report, prepared by Monenco Limited (Monenco, 1986), facility development and design studies were carried out in support of the OWMC Facilities Development Process. These studies were intended to supplement this report.

As noted in Volume 1 to this report, a series of facilities characteristics assumptions were employed to assist in the process of identifying, predicting and interpreting potential risks, impacts and costs. Volume 1 highlights these assumptions which were based on facility characteristics information provided by Monenco Limited (Monenco, 1985 and 1986). Other members of the site selection team developed additional assumptions, as required, by their individual analyses.

Initially the engineering consultant prepared a base case design. The basic case design did not vary from site-to-site. During the course of Phase 4A, refinements were made to the base case design by Monenco. These refinements were incorporated into the facilities characteristics assumptions. These base case changes were not the same for all siting options, and in some instances they had important implications for the prediction and interpretation of particular risks, impacts, and costs associated with certain siting options.

In addition to the base case changes, the layout of the facility was adjusted on a site-by-site basis. These site-specific refinements assisted in determining potential risks, impacts and costs.

This chapter highlights the major base case and site-specific modifications of particular relevance to the site selection process.

3.2 ENGINEERING CHANGES TO BASE CASE FACILITY DESIGN

At the outset of Phase 4A, the engineering consultant, Monenco Limited, prepared a base case facility design. The base case consisted of three possible facility arrangements - Case 1* with all three facility components on one site, Case 2* with the engineered landfill on one site and the physical/chemical treatment plant (including solidification) and incineration plant on another site, and Case 3* with a separate incineration plant on one site and the engineered landfill and physical/chemical treatment plant (including solidification) on another site. As noted in Chapter 7 of Volume 1, there are no Case 3 siting options.

As Phase 4A progressed, a number of changes were made to the initial base case design. These changes were a consequence of refinements and modifications introduced by Monenco and through other OWMC activities, notably the estimates of the geographic distribution of special wastes. A number of these changes had implications for site selection. The following major modifications were introduced:

- changes to the landfill design resulting from Gartner Lee Associates Ltd. Phase 4A drilling program affected landfill life;

- a new layout requiring a greater operating area reduced the landfill area.

Changes to facility design increased the operating area from 11.4 ha (Case 1) (Case 2 - 12.1 ha, Case 3 - 7.8 ha for incinerator and 6.5 ha for physical/chemical treatment plant) to 17.4 ha (Case 1) (Case 2 - 17.7 ha, Case 3 - 10.7 ha for incineration plant and 10.2 ha for physical/chemical treatment plant). This operating area change decreased landfill life somewhat. The base case criterion for minimum landfill life was 20 years. At the outset of Phase 4A the 20-year landfill life criterion could be achieved for all sites. The larger operating area resulted in a minor reduction in landfill life. Subsequently, landfill lives were reduced to a greater extent, with the identification by Gartner Lee Associates Ltd. of hydrogeologic and geotechnical constraints In all cases, landfill lives were reduced to less than the 20-year minimum criterion. Table 3.1 provides the landfill lives calculated at the outset of Phase 4A. It also lists the final Phase 4A landfill lives.

Figure 3.1 illustrates the base case layout of the operating area for an integrated facility. Figure 3.2 illustrates the revised base case layout for a Case 2 facility. The facility consists of a central operating area of approximately 17 ha. The central operating area is enclosed by a technical buffer zone. The technical buffer zone extends 400 m from the source of fugitive emissions within the operating area. A conventional landfill is assumed. The landfill is surrounded by a 50 m buffer. Both buffers are contained within the site acquisition boundary.

For site selection purposes, the conventional landfill cell is assumed to be 100 m in width. It has an excavation depth of 10 m and solidified material mounded to a height of 12 m above ground level. The central operating area has an excavation depth of 8 m.

As part of the revised base case, it was assumed that all archaeological resources would be mitigated according to guidelines established by the Ministry of Citizenship and Culture.

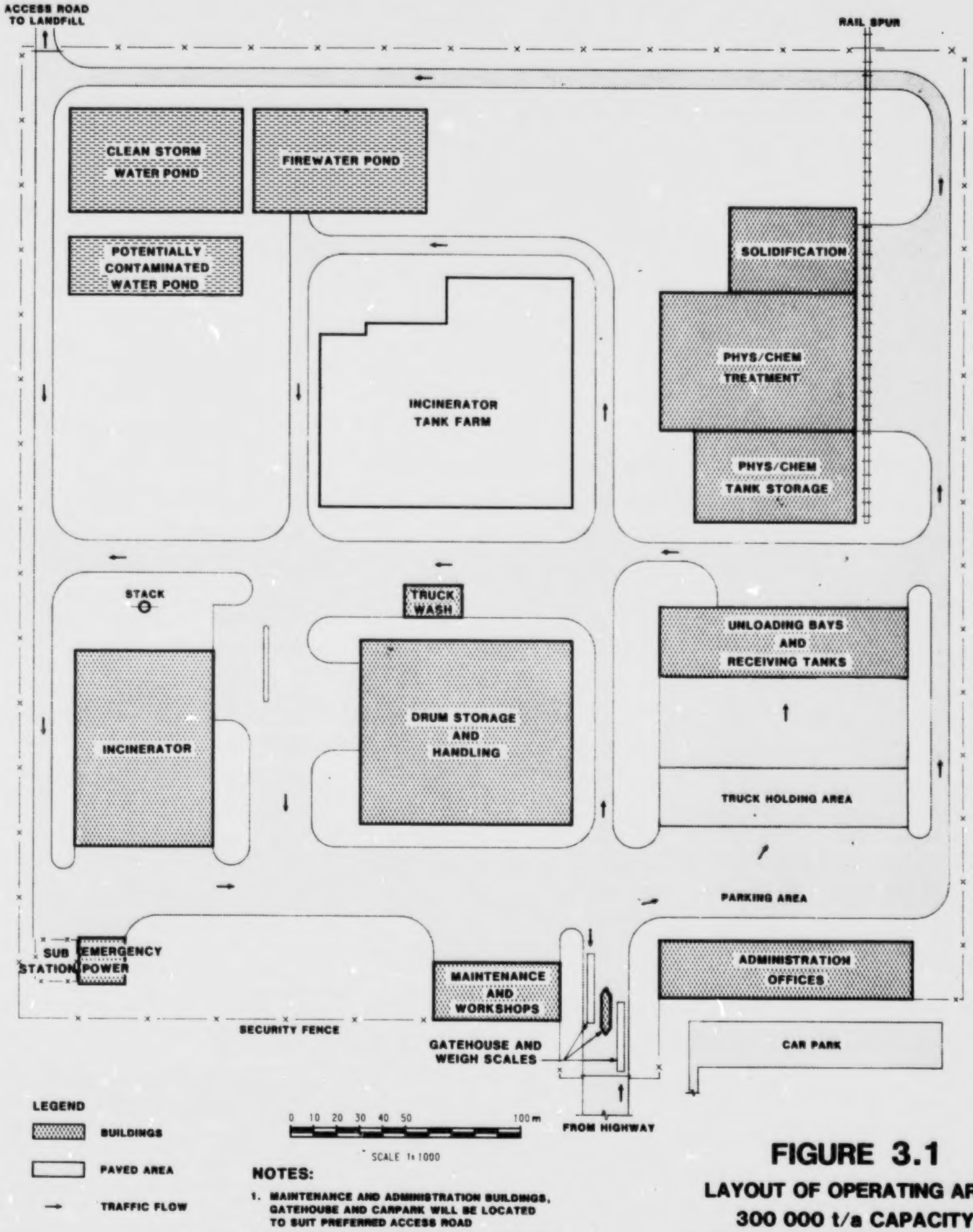
TABLE 3.1

Initial and Final Landfill Lives - Phase 4A

	Initial Landfill Lives (years)	Final Landfill Lives[2] (years)
LF-4N	24.5	15.5
LF-9C	20	14
LF-3C		19
LF-3CA[1]	21.0	
LF-3CB[1]	27.5	
LF-1E (integrated)		12
LF-1EA[1]	20.0	
LF-1EB[1]	27.0	
LF-1E (landfill only)		11.0
LF-1EA[1]	25.0	
LF-1EB[1]	27.0	

1 - Several layout options considered at this time

2 - Assumes total solidification of treated residues

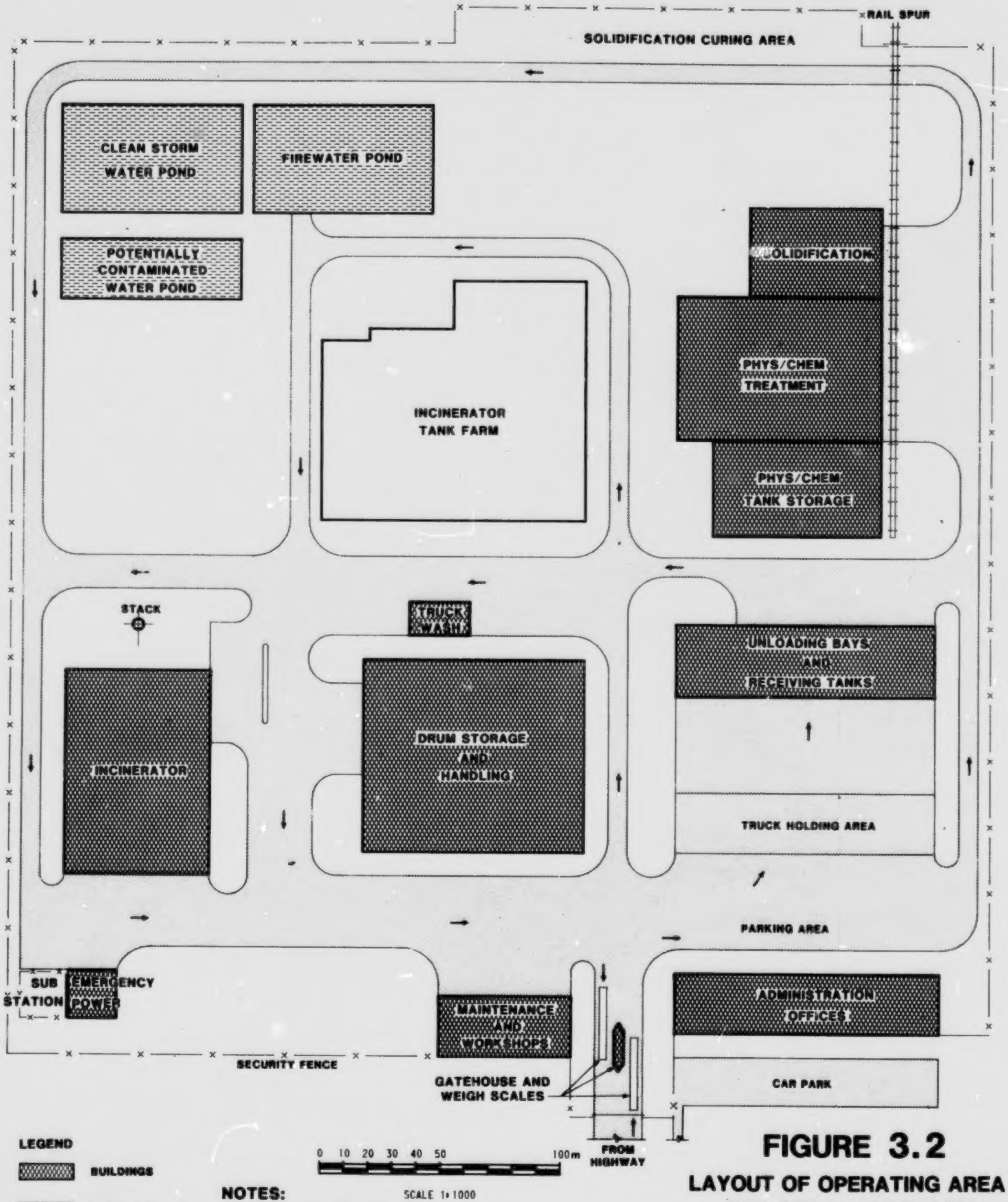

ACCESS ROAD TO LANDFILL
RAIL SPUR
CLEAN STORM WATER POND
FIREWATER POND
POTENTIALLY CONTAMINATED WATER POND
SOLIDIFICATION
INCINERATOR TANK FARM
PHYS/CHEM TREATMENT
PHYS/CHEM TANK STORAGE
STACK
TRUCK WASH
UNLOADING BAYS AND RECEIVING TANKS
INCINERATOR
DRUM STORAGE AND HANDLING
TRUCK HOLDING AREA
PARKING AREA
SUB STATION
EMERGENCY POWER
MAINTENANCE AND WORKSHOPS
ADMINISTRATION OFFICES
SECURITY FENCE
GATEHOUSE AND WEIGH SCALES
CAR PARK
FROM HIGHWAY
LEGEND
▨ BUILDINGS
▭ PAVED AREA
→ TRAFFIC FLOW
0 10 20 30 40 50 100 m
SCALE 1:1000

NOTES:

1. MAINTENANCE AND ADMINISTRATION BUILDINGS, GATEHOUSE AND CARPARK WILL BE LOCATED TO SUIT PREFERRED ACCESS ROAD
2. FOR ORIENTATION OF FACILITY SEE SITE LAYOUT OF SPECIFIC SITING OPTION

FIGURE 3.1
LAYOUT OF OPERATING AREA
300 000 t/a CAPACITY
CASE 1 - INTEGRATED FACILITY

Source: Monenco Limited. 1986. Site Selection Process. Phase 4A : Selection of a Preferred Site(s) - Engineering. Figure D.1


RAIL SPUR
SOLIDIFICATION CURING AREA
CLEAN STORM WATER POND
FIREWATER POND
POTENTIALLY CONTAMINATED WATER POND
SOLIDIFICATION
PHYS/CHEM TREATMENT
INCINERATOR TANK FARM
PHYS/CHEM TANK STORAGE
STACK
TRUCK WASH
UNLOADING BAYS AND RECEIVING TANKS
INCINERATOR
DRUM STORAGE AND HANDLING
TRUCK HOLDING AREA
PARKING AREA
SUB STATION
EMERGENCY POWER
MAINTENANCE AND WORKSHOPS
ADMINISTRATION OFFICES
CAR PARK
SECURITY FENCE
GATEHOUSE AND WEIGH SCALES
FROM HIGHWAY
0 10 20 30 40 50 100m
SCALE 1:1000
LEGEND
BUILDINGS
PAVED AREA
TRAFFIC FLOW

NOTES:

1. MAINTENANCE AND ADMINISTRATION BUILDINGS, GATEHOUSE AND CARPARK WILL BE LOCATED TO SUIT PREFERRED ACCESS ROAD
2. FOR ORIENTATION OF FACILITY SEE SITE LAYOUT OF SPECIFIC SITING OPTION

FIGURE 3.2
LAYOUT OF OPERATING AREA
300 000 t/a CAPACITY
CASE 2 - LANDFILL SEPARATE
PHYSICAL/CHEMICAL/INCINERATION FACILITY

Source: Monenco Limited. 1986. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Engineering. Figure D.2

3.3 SITE-SPECIFIC DESIGN MODIFICATIONS

3.3.1 PROCESS FOR INCORPORATING SITE-SPECIFIC DESIGN MODIFICATIONS

The process for incorporating site-specific changes into the engineering design is shown in Figure 3.3. As previously noted, specific design changes were developed by the engineering consultant for or as an outcome of the basic acceptability analysis. These changes resulted in a revised base case design. The revised base case design was used by the engineering consultant to formulate initial cost estimates.

The revised base case design was also used in risk and impact identification. The site selection team identified situations where design changes might assist in risk and impact reduction or elimination. The engineering consultant then incorporated feasible changes on a site-specific basis. Risk and impact prediction, and capital and operating cost estimates were then revised accordingly.

Layouts at a scale of 1:10,000 were prepared by the engineering consultant. These layouts were then superimposed on 1:10,000 base maps and on the physical settings of the candidate sites to verify whether or not the base case design could be accommodated. Consultants' base line data collected to date were considered in the review of the base case design.

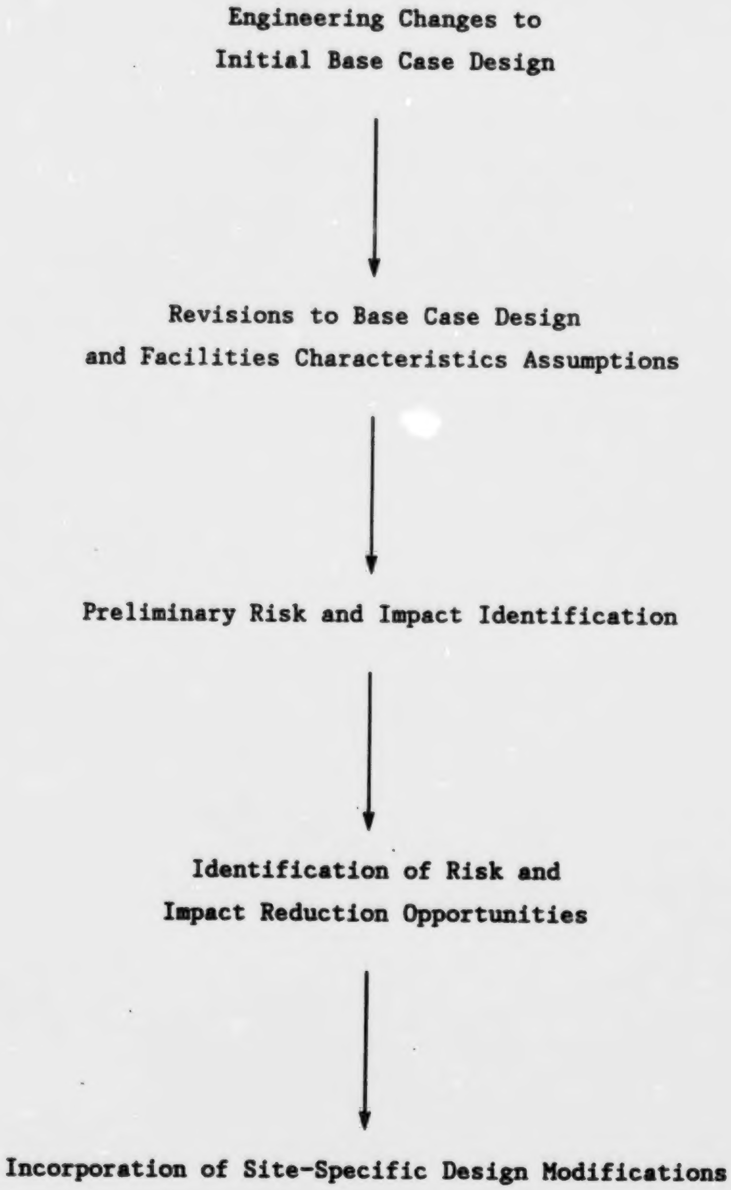
As noted in the Engineering report (Monenco, 1986), there were a number of instances where site-specific changes and/or adaptations could occur. These included:

- restrictions as a result of site features;

- changes required to the size and layout of process areas;

FIGURE 3.3

Process for Incorporating Site-Specific Design Modifications


Engineering Changes to Initial Base Case Design
Revisions to Base Case Design and Facilities Characteristics Assumptions
Preliminary Risk and Impact Identification
Identification of Risk and Impact Reduction Opportunities
Incorporation of Site-Specific Design Modifications

- foundation and structural design changes specific to the load-bearing capacity of each site;

- changes to landfill cell dimensions. Figure 3.4 illustrates site-specific changes to landfill cell dimensions, as compared to the base case conventional landfill;

- changes resulting from landfill area restrictions;

- changes to enhance natural containment.

In addition, the following were incorporated into Monenco's cost estimates:

- service connections to each site;

- off-site drainage improvements recommended by the surface water consultant, Gartner Lee Associates Ltd.;

- off-site road improvements identified by the transportation consultant, M.M. Dillon Ltd.;

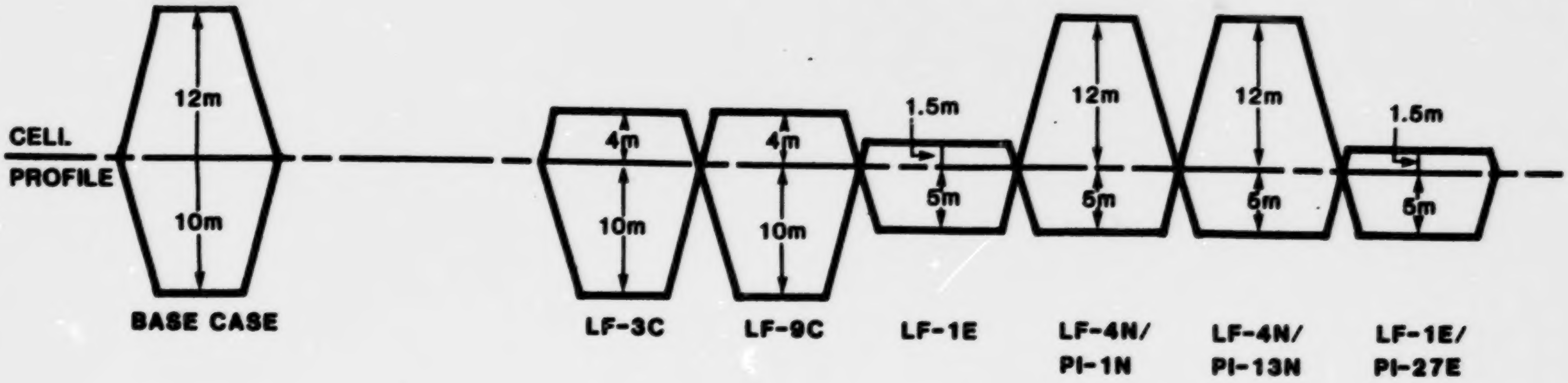
- any additional mitigative measures identified on a site-by-site basis.

3.3.2 SITE-BY-SITE MODIFICATIONS

The following subsection highlights engineering design changes on a site-by-site basis. In all cases, the engineering consultant verified that the access road and rail site entry points could be accommodated.

Off-site road improvements were identified by the transportation consultant for all siting options. These road improvements were costed by the transportation consultant. They were included as part of Monenco's cost

SITE SPECIFIC CHANGES TO LANDFILL CELL DIMENSIONS


CELL
PROFILE
12m
10m
BASE CASE
4m
10m
LF-3C
4m
10m
LF-9C
1.5m
5m
LF-1E
12m
5m
LF-4N/
PI-1N
12m
5m
LF-4N/
PI-13N
1.5m
5m
LF-1E/
PI-27E

Source: Monenco Limited, 1985 a Site Selection Process, Phase 4A

Selection of a Preferred Site(s) - Engineering

Figure 3.4

estimates. Further details regarding these changes can be found in Appendix H of the Phase 4A Transportation report (M.M. Dillon, 1985c).

a) LF-4N

Figure 3.5 illustrates the facility layout for LF-4N. It also notes site-specific design modifications.[1]

LF-4N is potentially hydrogeologically constrained. The basic acceptability analysis (Chapter 8, Volume 1) indicated that "the confining layer at LF-4N would not be completely penetrated by a 10 m deep excavation and the site is considered to be capable of providing some natural containment" (GLAL, 1985b, p.85). The natural containment potential of LF-4N was, however, enhanced through design modifications.

The hydrogeologic analysis indicated that contaminant containment potential could be increased by placing the facility on those portions of the site with the greatest confining layer thickness and decreasing the depth of landfill cells as shown in Figure 3.4. In the case of LF-4N, by restricting the landfill development to areas where the confining layer thickness exceeds 15 m, the range of contaminant breakthrough times could be significantly narrowed (GLAL, 1985b, p.103).

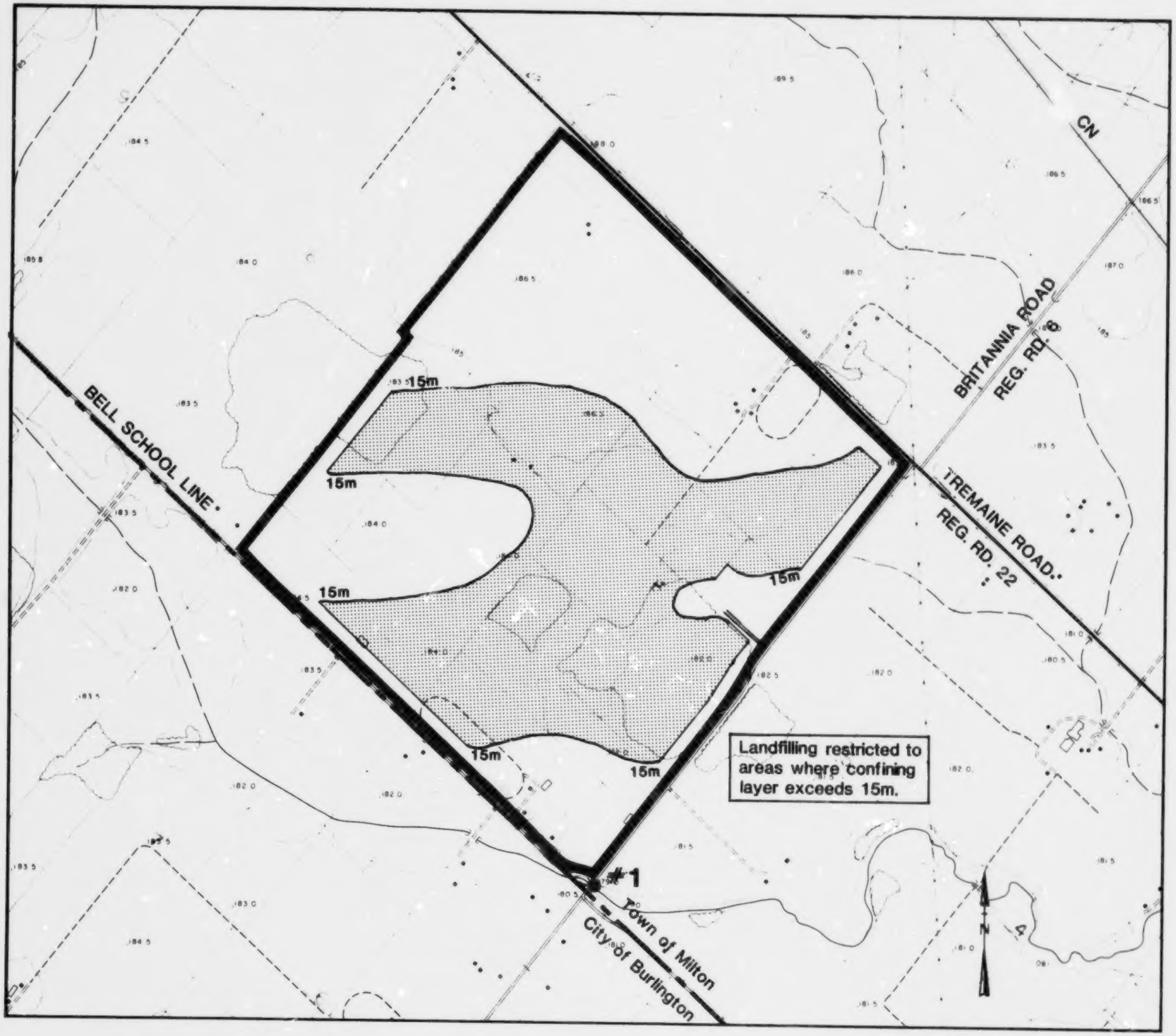
Gartner Lee Associates Ltd. recommended that the preferred storm water outfall location be near Culvert #1 on Indian Creek (GLAL, 1985d, p.120). This recommendation was incorporated into the site design.

b) PI-1N

Figure 3.6 illustrates the facility layout for PI-1N. It also notes site-specific design modifications.

---

[1] The base case design employed in the Gartner Lee Associates Ltd. analysis assumed a 10 m deep excavation. The Gartner Lee report did, however, indicate that restricting the depth of excavation to 5 m and/or limiting landfill development to areas above the confining layer thickness exceeds 15 m would enhance natural containment potential.


CN
BRITANNIA ROAD
REG. RD. 8
TREMAINE ROAD.
REG. RD. 22
BELL SCHOOL LINE
15m
15m
15m
15m
15m
15m
15m
Landfilling restricted to areas where confining layer exceeds 15m.
#1
Town of Milton
City of Burlington
N
4

OWMC Ontario Waste Management Corporation

Consultant

DILLON Monenco

Legend: LF - 4North

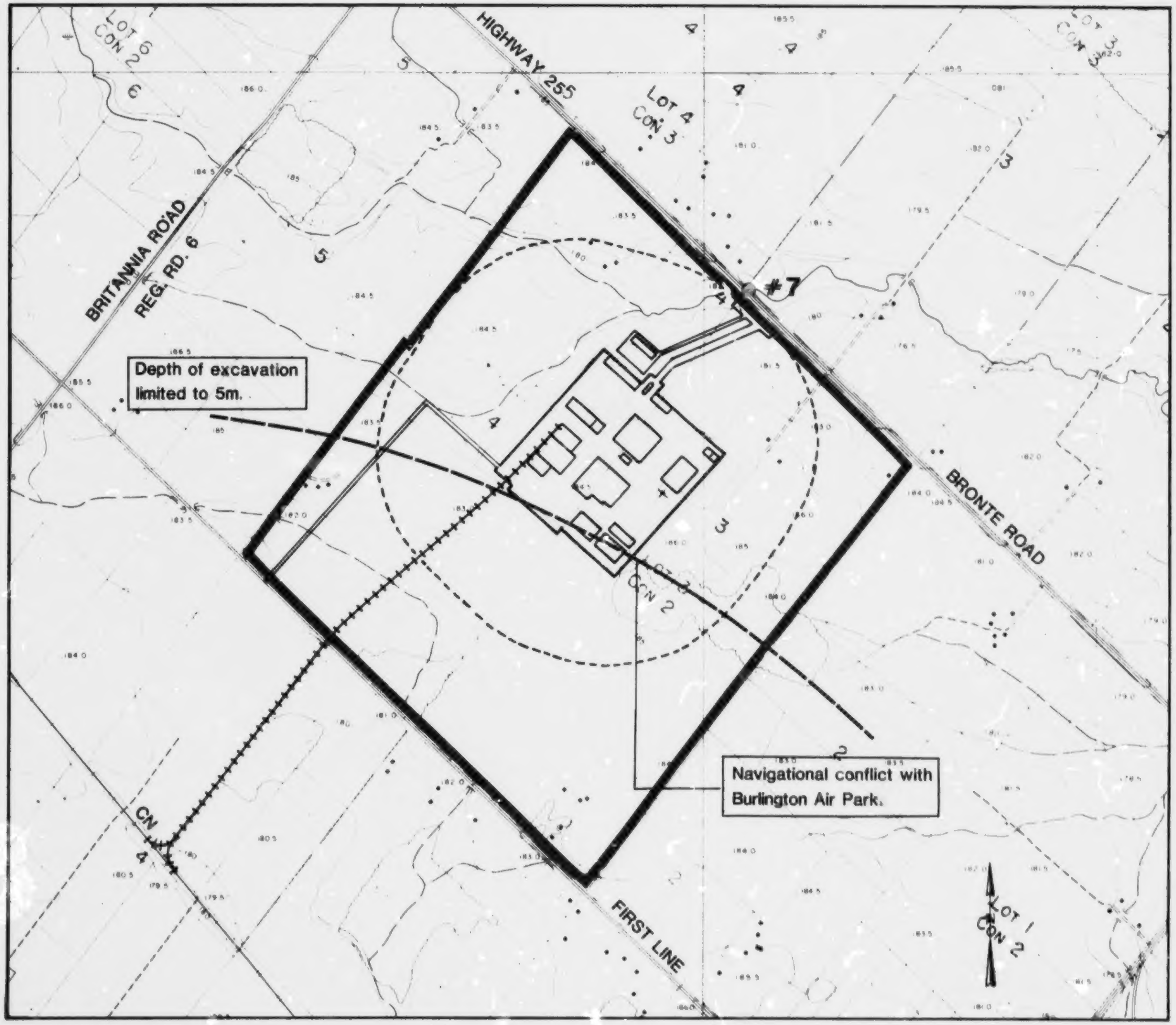
Symbol	Description
▬	Acquisition Boundary
▨	Landfill Area
- - -	Technical Buffer Zone
+++++++	Rail Spur
●	Culvert

Site-Specific Design Modifications

0 1000 feet
0 500 metres
1:10 000

SITE LAYOUT
CASE 2-
LANDFILL SEPARATE
LF-4N

1986 FIGURE 3.5


HIGHWAY 255
BRITANNIA ROAD
REG. RD. 6
BRONTE ROAD
FIRST LINE
CN
#7
LOT 6 CON 2
LOT 4 CON 3
LOT 3 CON 3
LOT 3 CON 2
LOT 1 CON 2

Depth of excavation limited to 5m.

Navigational conflict with Burlington Air Park.

OWMC Ontario Waste Management Corporation

Consultant

DILLON Monenco

Legend: PI-1North

Symbol	Description
▬	Acquisition Boundary
- - -	Technical Buffer Zone
+++++++	Rail Spur
●	Culvert
— —	4000 metre Radius

Site-Specific Design Modifications

0 1000 feet
0 500 metres
1:10 000

SITE LAYOUT
CASE 2-
LANDFILL SEPARATE
PI-1N

1986

FIGURE 3.6

The location of the incinerator stack was restricted by a navigational conflict. The transportation consultant, M.M. Dillon Ltd., noted that the westerly half of the site falls within the 4000 m navigational radius of Burlington Airpark. It was concluded that a stack height in excess of 45 m would create a serious navigational conflict with the Airpark. Facility development was therefore confined to that portion of the site east of the 4000 m navigational radius (M.M. Dillon, 1985b).

PI-1N was identified as potentially constrained hydrogeologically. When the basic acceptability screen was applied to PI-1N, assuming an excavation depth of 8 m, it was determined that the excavation would locally penetrate the aquifer. Thus, with an 8 m excavation, PI-1N potentially offered no natural containment.

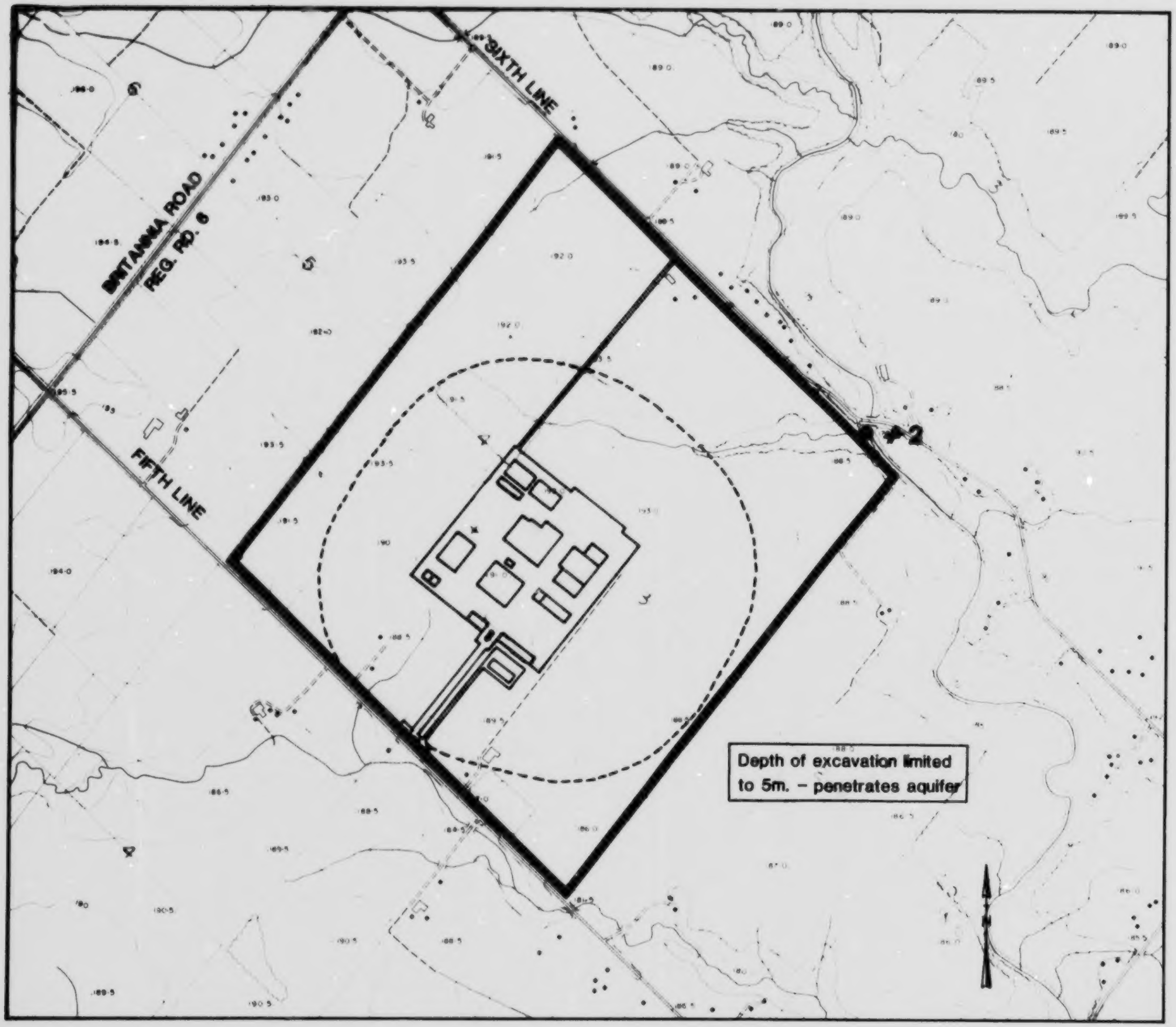
By altering the depth of excavation for the central operating area to 5 m, the confining layer would not be completely penetrated. As a result, some degree of natural containment would be provided. The engineering consultant noted that avoiding the penetration of the confining layer could, "be achieved by backfilling the portion of the site occupied by the central operating area with a 3 m layer of soil to raise the elevation of the foundations relative to the confining layer" (Monenco, 1986, p.74).

Gartner Lee Associates Ltd. recommended that the preferred storm water outfall location be at Culvert #7, flowing into Sixteen Mile Creek (GLAL, 1985d, p.104). This recommendation was incorporated into the site design.

c) PI-13N

Figure 3.7 illustrates the facility layout for PI-13N. It also summarizes the site-specific design modifications.

PI-13N was identified as potentially constrained hydrogeologically. When the basic acceptability screen was applied to PI-13N, assuming an excavation depth of 8 m, it was determined that the excavation would locally


SIXTH LINE
BRITANNIA ROAD
REG. RD. 8
FIFTH LINE
2

Depth of excavation limited to 5m. – penetrates aquifer

OWMC Ontario Waste Management Corporation

Consultant

DILLON Monenco

Legend: PI -13 North

Symbol	Description
▬	Acquisition Boundary
– – – –	Technical Buffer Zone
++++++++	Rail Spur
●	Culvert

Site-Specific Design Modifications

0 1000 feet
0 500 metres
1:10 000

SITE LAYOUT
CASE 2-
LANDFILL SEPARATE
PI-13N

1986

FIGURE 3.7

penetrate the aquifer. Thus, with an 8 m excavation, PI-13N potentially offered no natural containment. Raising the depth of excavation for the central operating area from 8 m to 5 m did not alter the constraint identified at PI-13N. It was therefore concluded that PI-13N failed to provide natural contaminant. As a result, it was recommended that PI-13N be considered basically unacceptable. The conclusions regarding PI-13N were not reached until the detailed comparative evaluation was largely completed. PI-13N, in combination with LF-4N, is therefore included in the detailed comparative evaluation.

The recommended storm water outfall location was at Culvert #2 into East Sixteen Mile Creek (GLAL, 1985d, p.87). This recommendation was incorporated into the site design.

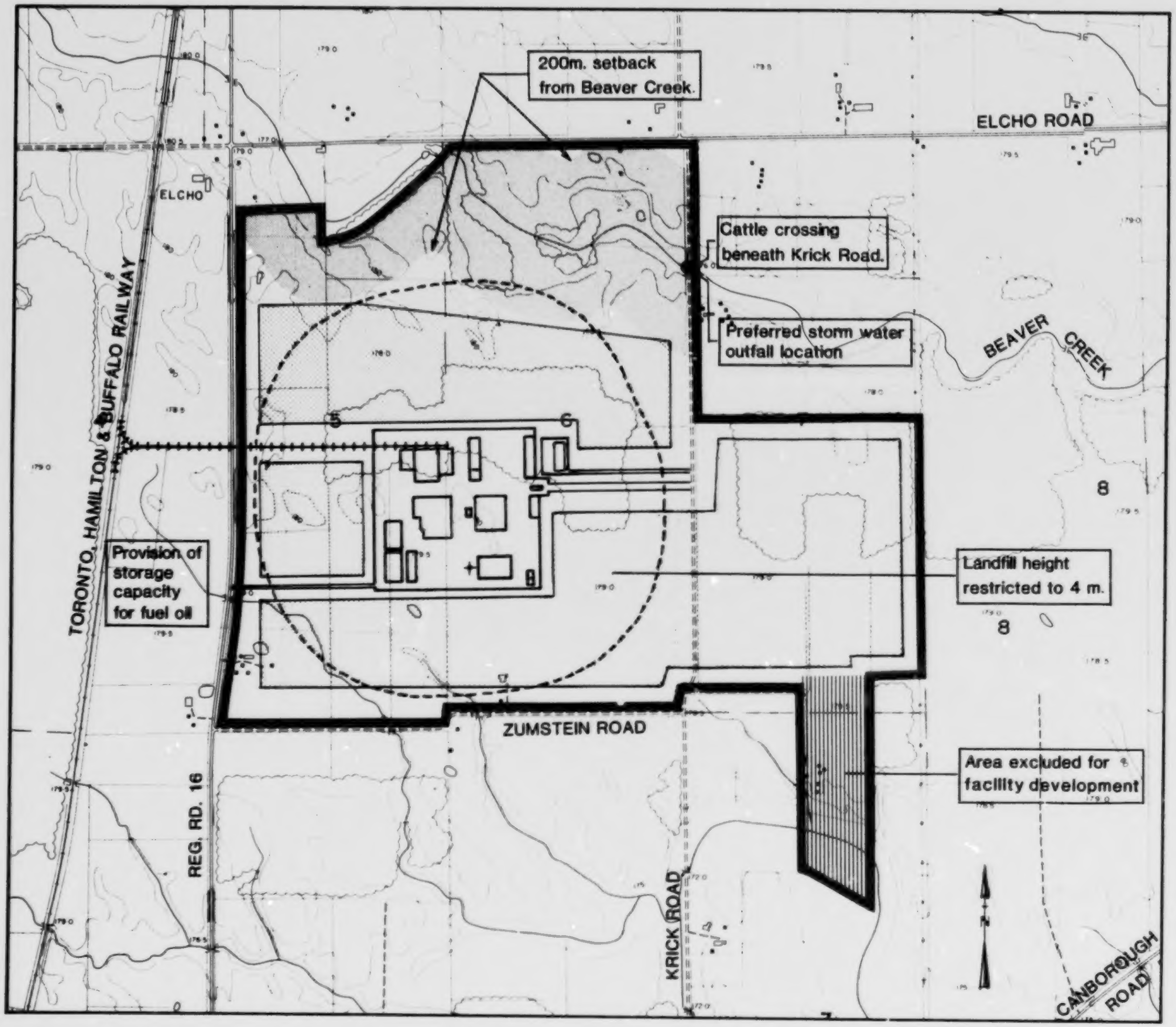
d) LF-3C

Figure 3.8 illustrates the facility layout for LF-3C. It also summarizes the site-specific design modifications.

As described in Chapter 4 of Volume 1, a 200 m setback was designated on each side of Beaver Creek. This setback minimized surface water risk potential. It also avoided several significant archaeological resources in the Beaver Creek floodplain. It was concluded that landfilling would not occur within the 200 m setback. In addition, it was determined that the finger of land in the south-east corner of the site would not be used for landfilling.

Natural gas is not available to LF-3C. Provision was therefore made in the layout for storage capacity for fuel oil. This fuel oil will be used as a start up and supplementary fuel at the incinerator site (Monenco, 1986).

Geotechnical considerations restricted the total landfill height at LF-3C to 4 m. Base case (10 m) excavation depth was not restricted with this siting option.


200m. setback from Beaver Creek.
Cattle crossing beneath Krick Road.
Preferred storm water outfall location
Landfill height restricted to 4 m.
Area excluded for facility development
Provision of storage capacity for fuel oil
ELCHO ROAD
ELCHO
BEAVER CREEK
TORONTO, HAMILTON & BUFFALO RAILWAY
REG. RD. 16
ZUMSTEIN ROAD
KRICK ROAD
CANBOROUGH ROAD
5
6
8
8
N

OWMC Ontario Waste Management Corporation

Consultant

DILLON **Monenco**

Legend: **LF - 3Central**

Symbol	Description
▬	Acquisition Boundary
☐	Landfill Area
– – –	Technical Buffer Zone
+++++++	Rail Spur
●	Culvert

Site-Specific Design Modifications

0 1000 feet
0 500 metres
1:10 000

SITE LAYOUT
CASE 1-
INTEGRATED SITE
LF-3C

1986 FIGURE 3.8

Gartner Lee Associates Ltd. recommended that the preferred storm water outfall be located at the culvert of Krick Road over Beaver Creek (GLAL, 1985d, p.140). This recommendation was incorporated into the site design.

The construction of a cattle crossing beneath Krick Road north of Elcho Road was identified as a specific mitigative measure for LF-3C. This crossing was costed by the transportation consultant. It was included as part of the design to reduce conflicts with frequent cattle crossings along Krick Road. The agricultural consultant, Ecologistics Limited, noted that, "cattle are moved between fields along Krick Road on a daily basis during the growing season" (Ecologistics, 1985, p.45).

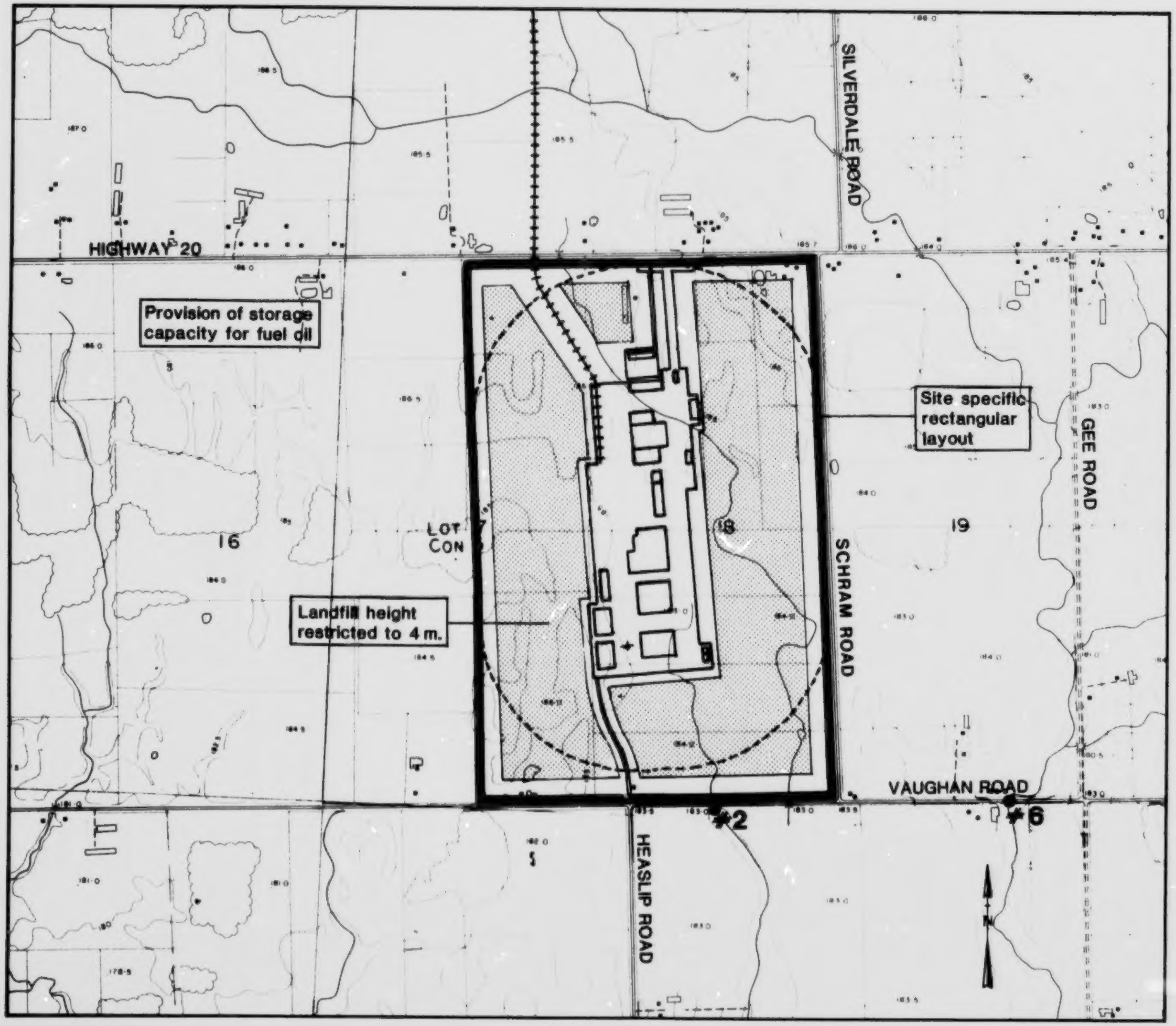
e) LF-9C

Figure 3.9 illustrates the facility layout for LF-9C. It also summarizes the site-specific design modifications.

Upon superimposing the base case modular layout on site LF-9C, it was determined that with this layout, the 400 m technical buffer zone could not be accommodated within the site acquisition boundaries. The layout of the central operating area was therefore modified from the modular design to a rectangular design so that the buffer zone could be accommodated within the site acquisition boundaries.

Another more minor change to the layout related to site servicing. Since natural gas is not available to LF-9C, this site required storage capacity for fuel oil, to be used as a start up and supplementary fuel at the incinerator site (Monenco, 1986).

In addition to the required change in layout, geotechnical considerations restricted the total landfill height at LF-9C to 4 m. Base case (10 m) excavation depth was not restricted with this siting option.


SILVERDALE ROAD
HIGHWAY 20
Provision of storage capacity for fuel oil
16
LOT
CON
18
Landfill height restricted to 4 m.
Site specific rectangular layout
SCHRAM ROAD
19
GEE ROAD
VAUGHAN ROAD
HEASLIP ROAD
#2
#6
N

OWMC Ontario Waste Management Corporation

Consultant

DILLON Monenco

Legend: **LF - 9Central**

Symbol	Description
▬	Acquisition Boundary
▭	Landfill Area
– – – –	Technical Buffer Zone
++++++	Rail Spur
●	Culvert

Site-Specific Design Modifications

0 1000 feet
0 500 metres
1:10 000

SITE LAYOUT
CASE 1-
INTEGRATED SITE
LF-9C

1986 FIGURE 3.9

Gartner Lee Associates Ltd. recommended that the preferred storm water outfall location be at Culvert #6. The storm water would then flow into Sucker Creek and then to the Welland River (GLAL, 1985d, p.157). This recommendation was incorporated into the site design.

f) LF-1E

i) Integrated Siting Option

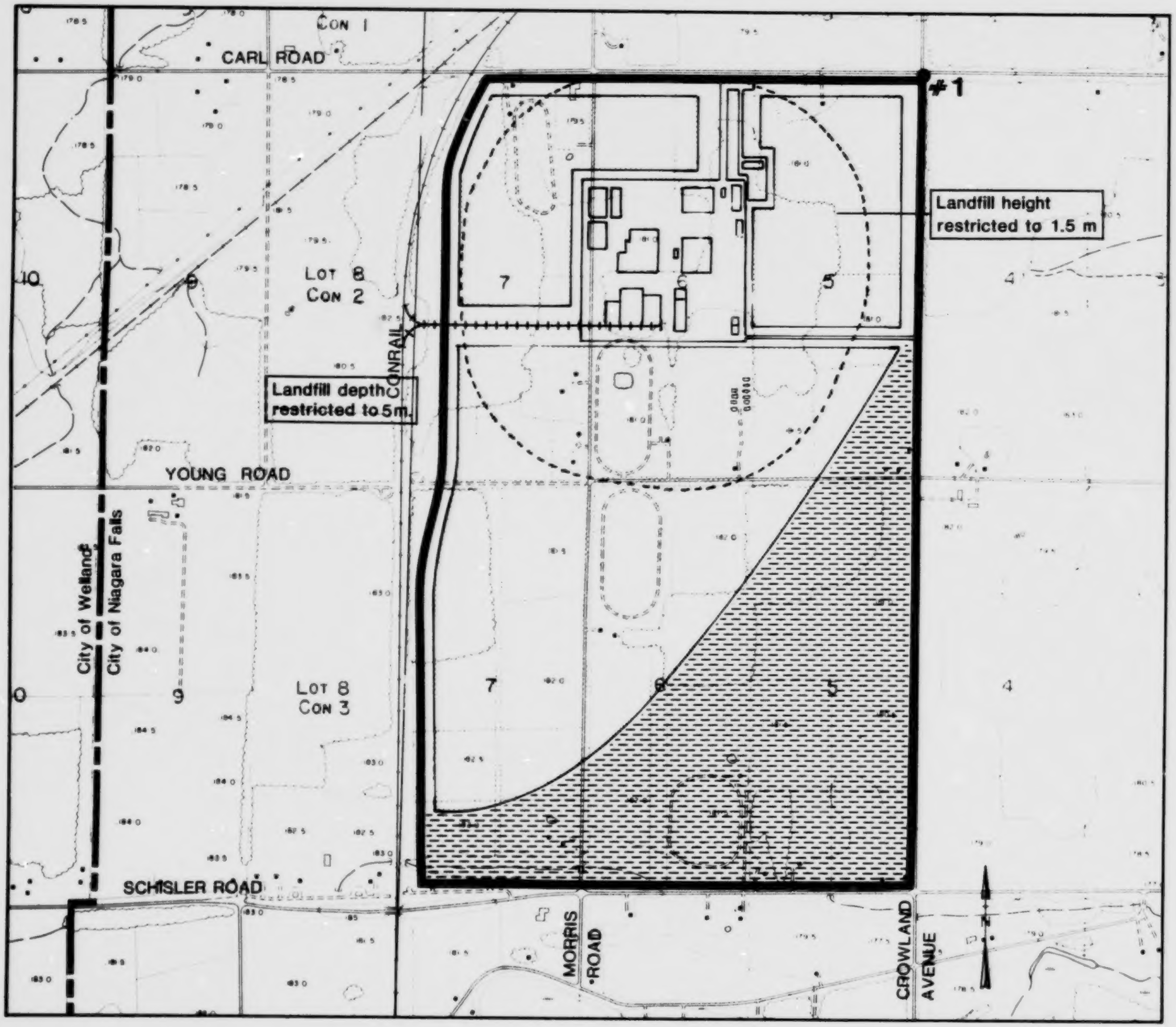
Figure 3.10 illustrates the facility layout for LF-1E integrated. It also summarizes the site-specific design modifications.

The location of the central operating area for LF-1E was restricted by a hydrogeologic constraint. The area available for facility development was restricted to the north half of the site. The hydrogeologic analysis indicated that the:

> "Confining layer thins to extinction under the southeastern portion of site as a result of a local morainal feature. Sand layers associated with the moraine could be present within the confining layer under the site" (GLAL, 1985b, p.80).

Geotechnical considerations also limited total landfill height and depth. Landfill height is restricted to 1.5 m. Landfill depth is restricted to 5 m.

Gartner Lee Associates Ltd. recommended that the preferred storm water outfall location be at Culvert #1 located at the intersection of Carl Road and Crowland Avenue (GLAL, 1985d, p.174). This recommendation was incorporated into the site design.


CON 1
CARL ROAD
LOT 8
CON 2
LOT 8
CON 3
YOUNG ROAD
SCHISLER ROAD
MORRIS ROAD
CROWLAND AVENUE
CONRAIL
City of Welland
City of Niagara Falls
#1
Landfill height restricted to 1.5 m
Landfill depth restricted to 5 m.
10
9
8
7
6
5
4

OWMC Ontario Waste Management Corporation

Consultant

DILLON Monenco

Legend: **LF-1East**

Symbol	Description
▬	Acquisition Boundary
▭	Landfill Area
- - - -	Technical Buffer Zone
++++++	Rail Spur
●	Culvert
▨	Hydrogeologic Constraint

Site-Specific Design Modifications

0 1000 feet
0 500 metres
1:10 000

SITE LAYOUT
CASE 1-
INTEGRATED SITE
LF-1E

1986

FIGURE 3.10

ii) Partially Integrated Siting Option (with PI-27E)

Figure 3.11 illustrates the facility layout for LF-1E (landfill only). It also summarizes the site-specific design modifications.

Landfill cell development on LF-1E is limited to the north half of the site. As described in Chapter 4 of Volume 1, the southeast portion of the site was excluded for landfilling purposes during the boundary refinement stage. The hydrogeologic analysis indicated that the confining layer thickness of this portion of the site appears to be less than 10 m. As a result, natural containment could not be assumed with landfill development on this portion of the site.

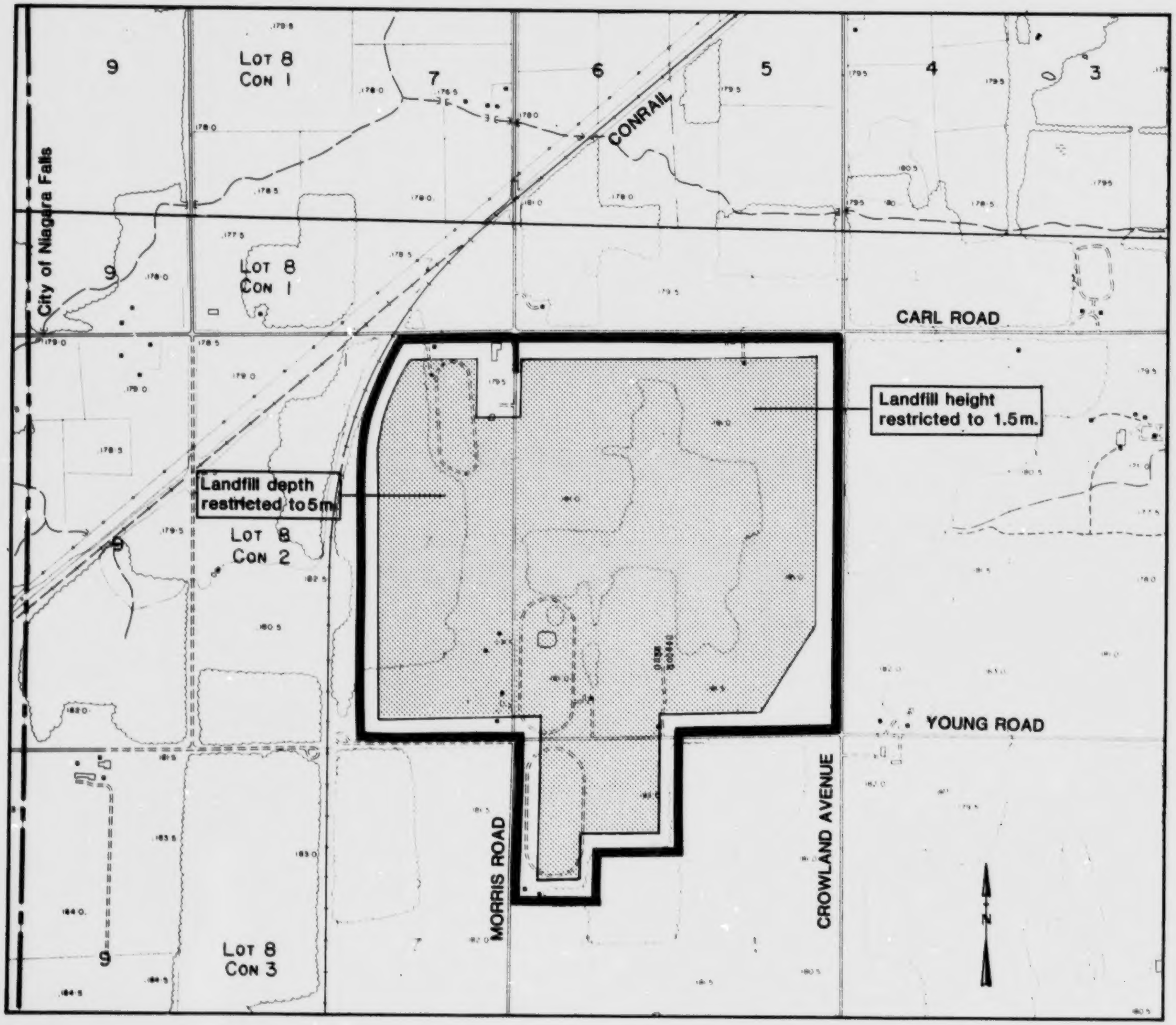
Geotechnical considerations limit the landfill height and depth. Landfill height is restricted to 1.5 m. Landfill depth is restricted to 5 m.

g) PI-27E

Figure 3.12 illustrates the facility layout for PI-27E. It also summarizes the site-specific design modifications.

The location of the central operating area for PI-27E is restricted by an existing ConRail line and a hydro line. Both easements bisect the site diagonally. Consequently, the operating area was confined to the area south of the rail line.

Site development is also restricted by a hydrogeologic constraint. The hydrogeologic analysis indicated an area of buried sand deposits under the northwestern portion of the site and to a lesser extent under the central portion of the site (GLAL, 1985b). The confining layer is more uniform under the southeast portion of the site. This area was therefore considered more conducive to facility development.


City of Niagara Falls
9
Lot 8
Con I
7
6
5
4
3
CONRAIL
9
Lot 8
Con I
CARL ROAD
Landfill height restricted to 1.5m.
Landfill depth restricted to 5m.
9
Lot 8
Con 2
YOUNG ROAD
MORRIS ROAD
CROWLAND AVENUE
N
9
Lot 8
Con 3

OWMC Ontario Waste Management Corporation

Consultant

DILLON **Monenco**

Legend: **LF-1East**

Symbol	Description
▬	Acquisition Boundary
▭	Landfill Area
- - - -	Technical Buffer Zone
++++++	Rail Spur

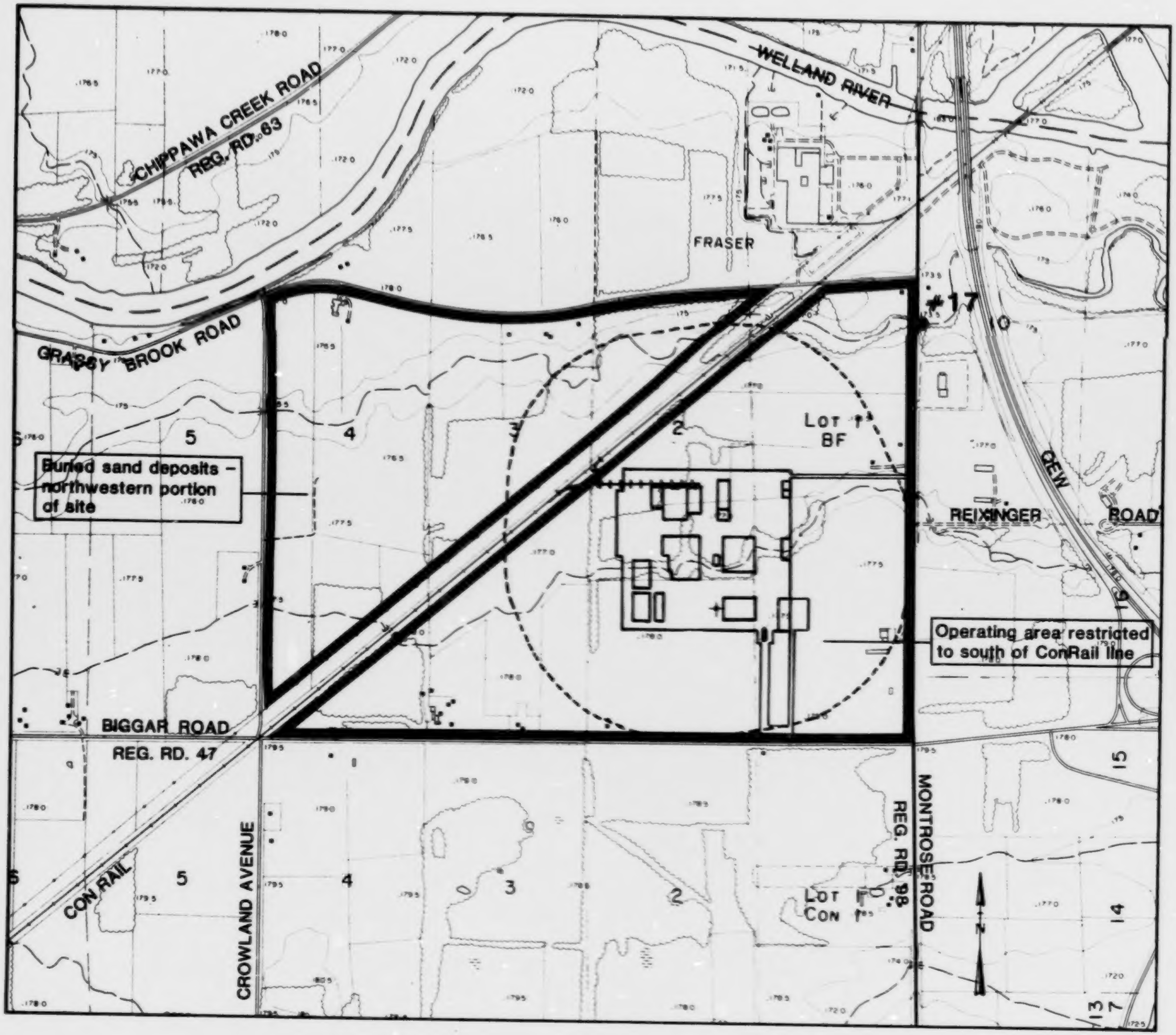
Site-Specific Design Modifications

0 1000 feet
0 500 metres
1:10 000

SITE LAYOUT
CASE 2-
LANDFILL SEPARATE
LF-1E

1986

FIGURE 3.11


CHIPPAWA CREEK ROAD
REG. RD. 63
WELLAND RIVER
FRASER
GRASSY BROOK ROAD
Buried sand deposits – northwestern portion of site
LOT 1 BF
REIXINGER ROAD
QEW
#17
Operating area restricted to south of ConRail line
BIGGAR ROAD
REG. RD. 47
CROWLAND AVENUE
CON RAIL
MONTROSE ROAD
REG. RD. 98
LOT 1 CON 1
N
1
2
3
4
5
6
10
13
14
15
16

OWMC Ontario Waste Management Corporation

Consultant

DILLON Monenco

Legend: PI-27 East

Symbol	Description
▬	Acquisition Boundary
– – –	Technical Buffer Zone
+++++++	Rail Spur
●	Culvert

Site-Specific Design Modifications

0 1000 feet
0 500 metres
1:10 000

SITE LAYOUT
CASE 2-
LANDFILL SEPARATE
PI-27E

1986 FIGURE 3.12

Gartner Lee Associates Ltd. recommended that the preferred storm water outfall location be at Culvert #17 at Grassy Brook (GLAL, 1985d, p.188). This recommendation was incorporated into the site design.

4.0 FACTOR IDENTIFICATION, REFINEMENT AND RANKING

4.1 INTRODUCTION

4.1.1 PURPOSE

This chapter documents the factor[1] identification, refinement and ranking process.

Table B.1 in Appendix B contains a list of the factors used to compare siting options. In this chapter, the considerations applied to identify factors are described. The process used to refine the factors is based on technical, public and agency inputs.

Some factors are more important than others for siting option comparison purposes. This chapter also details the risk and impact[2] factor ranking process.

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[1] Factors are subdivided into indicators. The procedures employed to identify, refine and rank indicators are described in the individual site selection consultant reports.

[2] Risk factors measure or describe potential transportation, air emissions, ground and surface water risks to human health. Impact factors pertain to non-human health-related effects of the facility, e.g. displacement of biological resources, community character changes.

4.1.2 FACTOR IDENTIFICATION, REFINEMENT AND RANKING PROCESS

The process for identifying, refining and ranking factors is illustrated in Figure 4.1. As indicated in the figure, the initial factor list and the initial factor ranking were based on site selection team inputs.

Refinements to factors and factor rankings occurred in parallel. The two activities are closely connected. Changes in factors frequently had ranking implications. The factor ranking process often resulted in factor modifications.

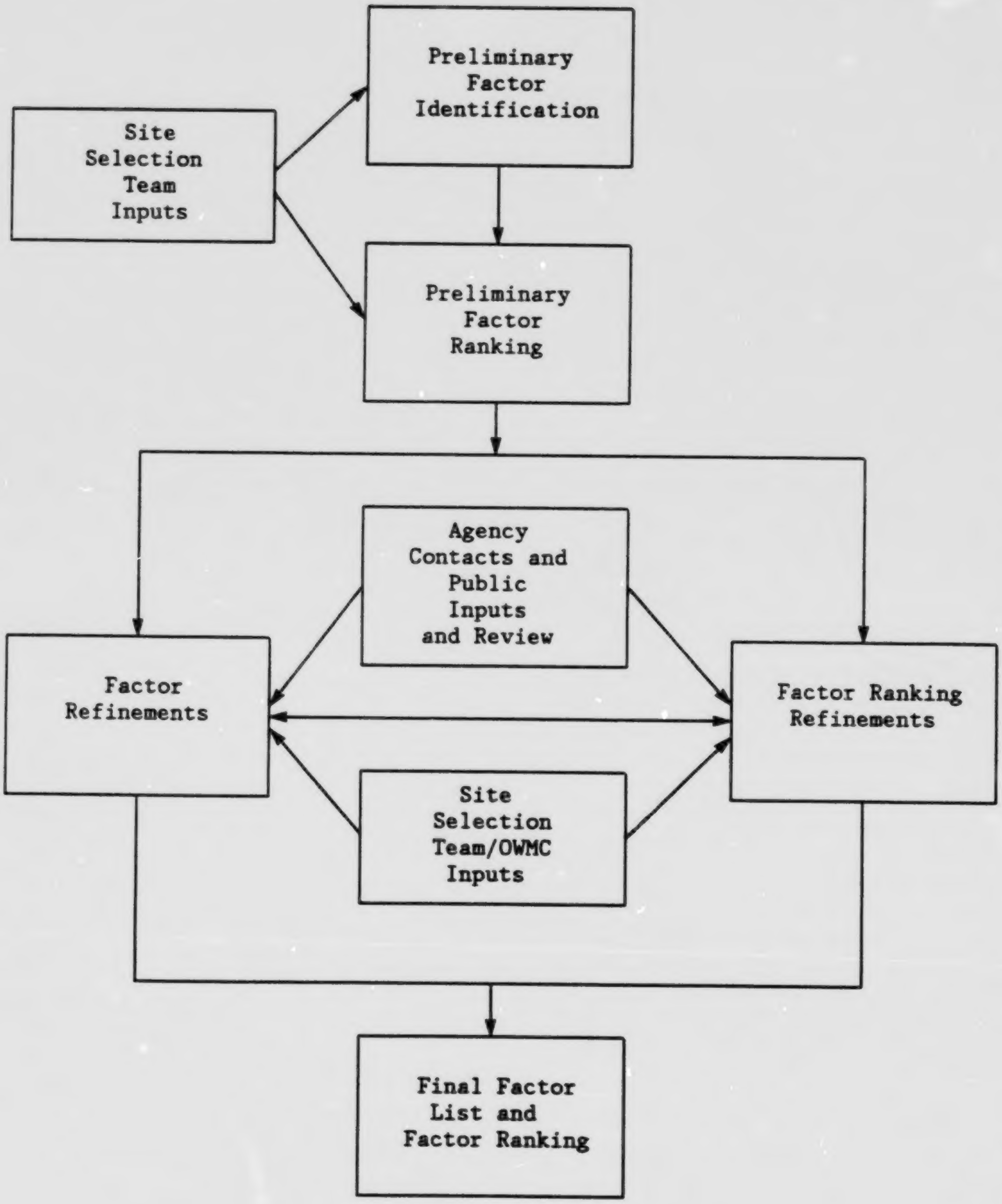
Inputs to the refinement and ranking of factors have been received from both the site selection team and through agency contacts and public inputs and review. In the case of the site selection team, refinements occurred as a result of the data collection and analysis process, revisions to facility characteristics assumptions, results of the evaluation process and technical review and modifications. Modifications stemmed from meetings, document review, reviews of briefs and submissions, direct contacts with individuals and groups through the "walk and talk program". Modifications also arose from consultant meetings with interest and site groups and OWMC Public Workshops (see OWMC Phase 4A Public Consultation Report, 1986).

Each site selection consultant contributed to the ranking of factors within their disciplines. Each consultant grouped their factors into as many ranking levels as they could substantiate and which were warranted for siting option ranking purposes. The coordinating site selection consultant, M.M. Dillon Ltd., prepared a composite factor ranking based on the consultants' inputs. The composite factor ranking was then reviewed by the site selection team, OWMC, the public (through OWMC workshops) and agencies. Refinements were made based on the comments received.

Consultants responsible for several factors used either a 5 or a 10 level ranking system. Differences between ranking levels were expressed,

FIGURE 4.1

Factor Identification, Refinement and Ranking Process


Site Selection Team Inputs
Preliminary Factor Identification
Preliminary Factor Ranking
Agency Contacts and Public Inputs and Review
Factor Refinements
Factor Ranking Refinements
Site Selection Team/OWMC Inputs
Final Factor List and Factor Ranking

where possible, through either decimal places, e.g. 4.2, 3.1 or by a point system, e.g. 1200 points for one factor, 600 points for another.

In view of the considerable differences in concerns addressed by the various consultants, each consultant determined the manner and extent to which factors were ranked. The rationale for the procedures employed by each consultant are contained in their individual site selection reports.

A 10-level overall ranking system was employed by Dillon Site Selection. A 10-level system encompasses major distinctions made by the individual consultants. It also provides an adequate reflection of the relative importance of factors for siting option comparison purposes.

Engineering factors have not been ranked. Costs can be aggregated through such composite indices as present value of lifestyle annual costs. In addition:

- cost is considered the least important goal;
- all siting options are basically acceptable from an engineering perspective (Chapter 8, Volume 1);
- the differences among the siting options from an engineering perspective are quite limited.

As a result of the above, engineering factors have only been used to supplement and refine distinctions made on the basis of risks and impact factors.

4.1.3 CHAPTER FORMAT

This chapter is divided into three major sections. In Section 4.2, the factor identification and refinement process is described (Section 4.2.1). The considerations employed to identify and then to refine factors are also presented (Section 4.2.2).

Section 4.3 addresses the ranking of risk factors. This section begins by providing some background information necessary to understand the treatment of risk for factor ranking purposes (Section 4.3.2). A detailed description of the approach employed in the ranking of risk factors is then presented (Section 4.3.3). Finally, the detailed step-by-step procedure employed to rank the risk factors is presented (Sections 4.3.4 to 4.3.7 - corresponding to Steps 1 to 4). This section of the report is quite lengthy. However, by presenting the step-by-step procedure by which the risk factor rankings were determined, it is felt that the basis for the final rankings would be more easily understood.

Section 4.4 addresses the ranking of impact factors. This section begins with an overview of the approach employed to rank the impact factors (Section 4.4.2). The approach section includes a description of the factor ranking process and the factor ranking criteria. The detailed step-by-step procedure employed to rank the impact factors is then presented (Sections 4.4.3 to 4.4.6). As with the risk factors, the impact factor ranking process involves four steps. The description of the impact factor ranking process is detailed and lengthy. Again, however, it is felt that the final impact factor rankings would be more easily understood if the process by which these rankings are determined is described.

4.2 FACTOR IDENTIFICATION AND REFINEMENT

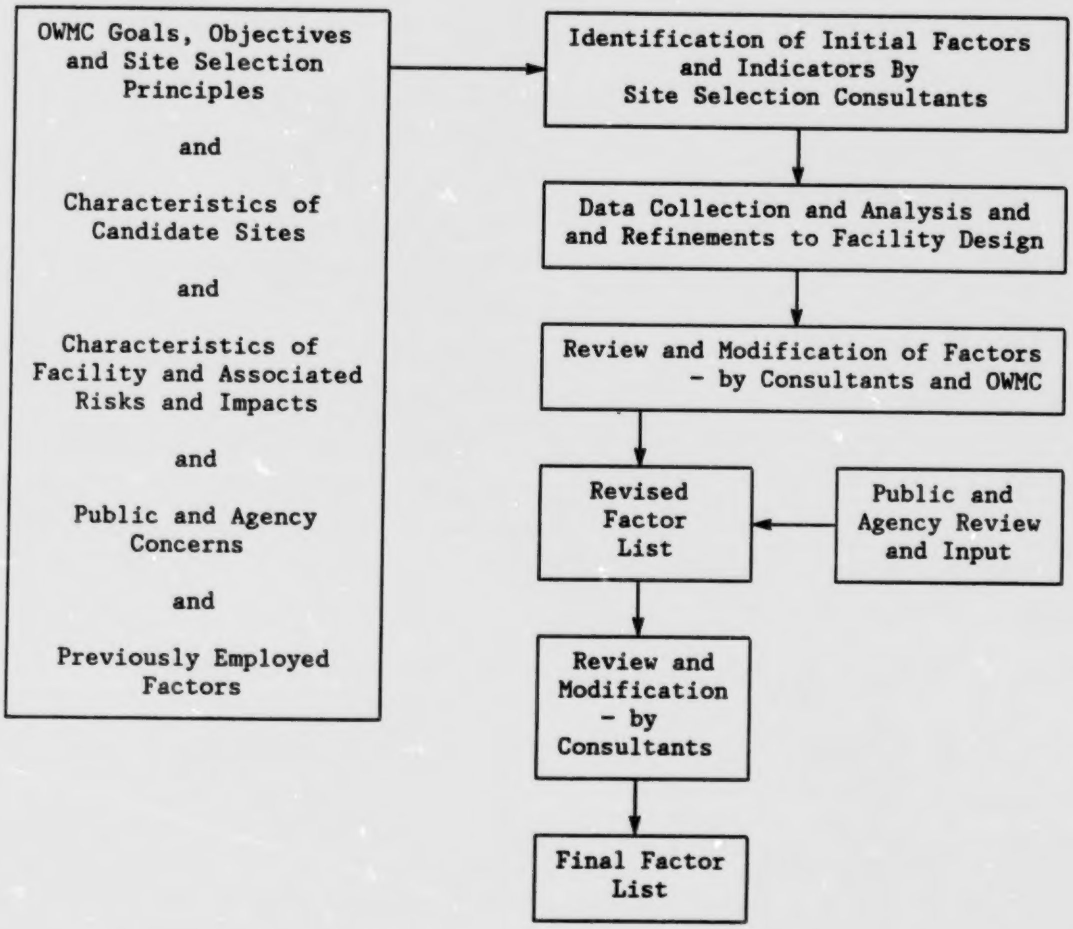
4.2.1 FACTOR IDENTIFICATION AND REFINEMENT PROCESS

Factor identification and refinement took place in a series of steps. Figure 4.2 identifies the major steps and considerations in factor identification.

The initial factor list was presented to the public in the OWMC document entitled Phase 4A Factors (OWMC, 1985a). Refinements to factors took

FIGURE 4.2

Steps in Factor Identification and Refinement


OWMC Goals, Objectives and Site Selection Principles
and
Characteristics of Candidate Sites
and
Characteristics of Facility and Associated Risks and Impacts
and
Public and Agency Concerns
and
Previously Employed Factors
Identification of Initial Factors and Indicators By Site Selection Consultants
Data Collection and Analysis and and Refinements to Facility Design
Review and Modification of Factors - by Consultants and OWMC
Revised Factor List
Public and Agency Review and Input
Review and Modification - by Consultants
Final Factor List

place as a result of public and agency review and input, and as a result of technical review and modifications.

4.2.2 CONSIDERATIONS IN FACTOR IDENTIFICATION

The following subsection describes the main considerations in factor identification:

a) Refinement and Elaboration of Phase 3B Factors

The Phase 4A factors facilitated the detailed comparative evaluation of siting options. The supplementary data collected in Phase 4A provided an increased level of detail for some Phase 3B factors. Further factors were added to reflect new data obtained through such sources as on-site field investigations, surveys of local residents and groups, and a more detailed analysis of access roads, site vicinity and community and regional risks, impacts and costs. The site selection consultants incorporated into the Phase 4A factors concerns identified by the public and agencies. These changes resulted in a new organizational structure for the factors. Table B.2 in Appendix B compares the Phase 3B and Phase 4A factors and provides a rationale for the treatment of each factor in Phase 4A.

b) Site Selection Principles

The site selection principles also contributed to the identification of site selection factors and indicators.[1]

The application of the principles in Phase 4A factor identification is described in Table B.3 Appendix B.

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[1] See Table B.3

c) Site Selection Goals and Objectives

Dillon Site Selection identified the relationship of the OWMC goals and objectives to the comprehensive list of site selection factors and indicators. Table B.4 in Appendix B shows the relationship of the Phase 4A factors to the site selection goals and objectives. In Phase 4A only a few objectives are not encompassed by the factors. The objectives not addressed represent policy areas being or to be addressed by OWMC.

d) Characteristics of the Candidate Sites

The site selection team chose the factors for Phase 4A to reflect the characteristics of the candidate sites, their vicinities, their communities and the access routes to and between the candidate sites. The review process by the public and agencies contributed to the identification of major concerns within each study area.

e) Facilities Characteristic Information

Information provided by the engineering consultant, Monenco Ltd., played an important role in the formulation of factors and indicators. Engineering inputs have been used to assist in the prediction of the nature of potential risks, impacts and costs. Factors and indicators were chosen to predict the levels of potential risks, impacts and costs of the OWMC facilities associated with each siting option.

The engineering consultants provided data on the:

- characteristics of facility and facility operations (e.g. emissions, noise, dust, lighting, construction vs. facility operations);
- type and characteristics of potential events (e.g. explosion, tank farm fire).

This information is essential to the choice of measures of potential risks, impacts and costs of the OWMC facility.

f) The Generic Risk Assessment

The generic risk assessment helped to identify some of the risk factors and indicators. Distinctions have been made among:

1. different types of events and sources of release (e.g. spills and accidents, stack emissions, fugitive emissions*);
2. important pathways by which a chemical release into the environment could be transported to a human receptor (e.g. air, surface water)[1];
3. different forms of human exposure* (e.g. inhalation, water or food consumption).

The generic risk assessment also contributed to the definition of study areas within which the factors were applied.

4.2.3 CONSIDERATIONS IN FACTOR AND INDICATOR REFINEMENT

The following lists the main considerations in factor refinement:

a) Public and Agency Review

Public comments and suggestions regarding a preliminary list of factors were obtained at two OWMC meetings held in January, 1985. Agency review took place at one OWMC meeting in March, 1985. Submissions to OWMC and records of meetings were reviewed to obtain further information regarding which factors should be used in Phase 4A. Each of these inputs is described in more detail below.

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[1] For site selection purposes, the air pathway was divided into two routes of contact for humans - air emissions from the facility and spills.

A document was prepared explaining the purpose of the factors, and listing and describing each of the preliminary factors and indicators identified by the site selection consultants (OWMC, 1984). This document was circulated to local community groups and OWMC Outreach groups across the Province. Two meetings were arranged by OWMC to discuss the factors on January 28 and 31, 1985. At these meetings the attendees commented on the Phase 4A preliminary factors. A list of the issues raised at these meetings and responses by OWMC's consultants are contained in Background Material for the OWMC Phase 4A Site Selection Workshops, Volume 1 (OWMC, 1985b). Tables B.5 and B.6 in Appendix B contain a list of all changes made to factors during Phase 4A and an explanation for each change including responses to public concerns.

In addition to the input obtained from these meetings, submissions were received by OWMC regarding Phase 4A factors. A cross-check of submissions received by OWMC and reports of meetings held in Phase 4A (between March 15, 1984 and September 26, 1985) was conducted. It was determined that all site selection issues raised by the public and agencies had been considered in Phase 4A site selection. Table C.8 in Appendix C lists the public and agency issues addressed by each factor in site selection. Table C.7 in Appendix C lists the response to each issue raised in terms of factor application. This table includes an explanation for the screening of any issue from site selection.

b) Technical Review and Modification

Technical modifications to factors were made for the following reasons:

- Factors were combined when they measured similar risks, impacts or engineering considerations.

- Individual indicators within factors were separated into factors when they measured very different risks, impacts or engineering considerations.

- Factors were modified to measure more precisely or depict potential risks, impacts or costs.

- As data were gathered, factors were modified or added to accommodate additional receptors, new or revised impact and risk study zones or the identification of new risks, impacts or engineering considerations.

- Changes to the facility design and new/revised engineering considerations.

- Factors and/or indicators were removed from the analysis (screened) for the following reasons:

  - no difference among options;
  - not possible to operationalize;
  - no, negligible or insignificant levels of risk, impact or cost.

  These criteria are interpreted on a factor by factor basis.

Tables B.5 and B.6 in Appendix B list the initial factors, refinements to factors and a rationale for the changes. The final list of factors includes 12 risk factors and 54 impact factors (see Table B.1).

4.3 RANKING OF RISK FACTORS

4.3.1 INTRODUCTION

This portion of the chapter details the process for grouping and ranking the 12 risk factors.

The following 12 risk factors are used to compare the siting options:

- Transportation - province-wide accident involvements of OWMC generated transport;

- transportation risks on local and regional access roads due to accident involvements of OWMC generated transport;
- province-wide hazard-based spills as a result of OWMC generated transport;
- transportation risks on local and regional access roads due to hazard-based spills of OWMC generated transport;

o Air
- risks from direct inhalation* of emissions - chronic;
- risks from direct inhalation of emissions - acute;
- risks from ingestion* of cistern and pond water;
- risks from consumption of crops and livestock;

o Ground Water
- capability of providing natural containment;
- impact on ground water use;

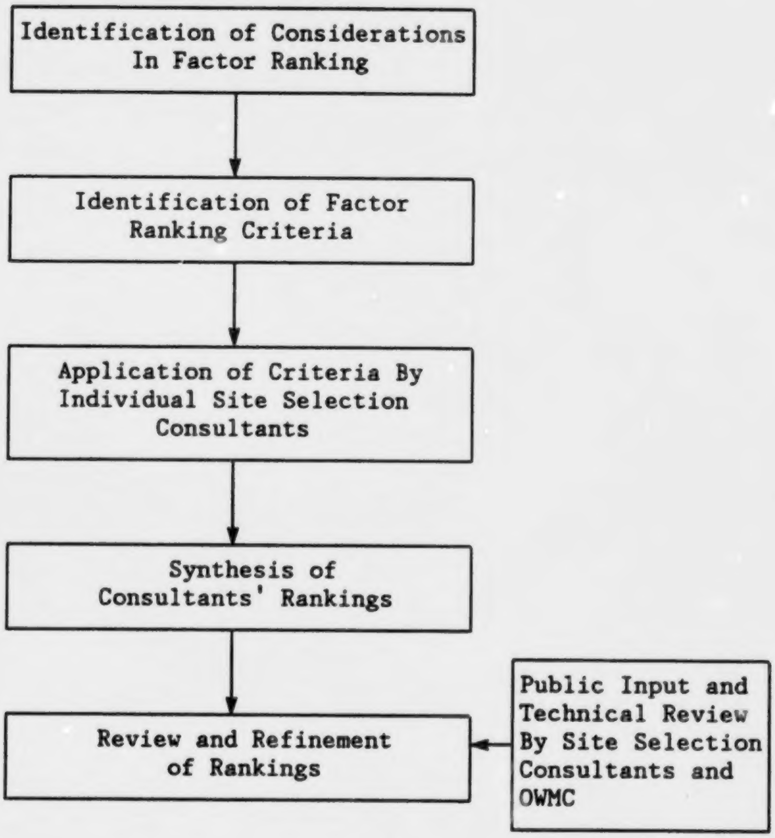
o Surface Water
- susceptibility of site to flooding;
- potential for surface water use interference.

a) Factor Ranking Process

The factor ranking process began with the individual site selection consultants (see Figure 4.3). Each site selection consultant applied the factor ranking criteria to their factors. The rationale for the rankings

FIGURE 4.3

Factor Ranking Process


Identification of Considerations In Factor Ranking
Identification of Factor Ranking Criteria
Application of Criteria By Individual Site Selection Consultants
Synthesis of Consultants' Rankings
Review and Refinement of Rankings
Public Input and Technical Review By Site Selection Consultants and OWMC

applied are listed in the individual consultant's reports. Table B.7 in Appendix B summarizes the consultant's risk factor rankings.

The consultants' factor rankings, together with their supporting reasons, were the point of departure for the formulation of a combined factor rankings by the site selection coordinating consultant.

The review and refinement of the factor rankings involved a considerable amount of participation by the site selection consultants. Agency and public inputs also assumed a key role in the factor ranking process.

b) Section Format

This section of Chapter 4 is divided into the following subsections:

Section 4.3.2	-	introductory material on risk and risk assessment, the OWMC role in risk minimization and predicted OWMC risks in perspective.
Section 4.3.3	-	risk factor ranking approach, including assumptions, ranking criteria and the factor ranking steps.
Sections 4.3.4-4.3.7	-	the step-by-step description of risk factor ranking.

4.3.2 BACKGROUND

The following background materials are intended to assist the reader in understanding the analysis and tradeoffs employed in the ranking of risk factors. It also places the site selection risks within the broader context of the OWMC risk minimization activities and other voluntary and involuntary risks.

a) Generic Risk Assessment*

Risk and Risk Assessment

For the purposes of this project, risk posed by a chemical agent is defined as the probability of injury, disease, or death occurring under specific conditions of exposure to toxic* and hazardous materials. The scientific activity of evaluating the toxic properties of materials, the conditions of human exposure to them and the characterization of the nature of the effects they may experience, is called risk assessment. The proper evaluation of public health risk requires an understanding of the inherent toxicity of substances to which people may be exposed and the definition, the pathway, magnitude and duration of likely exposure. Where a precise definition of all exposure variables is unknown, certain conservative* or "worst case" assumptions can be made. In the risk analysis performed for OWMC, for example, it is assumed that (for long-term emissions) an individual would be exposed directly to emissions from the facility for 30 years which was assumed to be the entire operating period of the facility (Environ, 1985).[1]

In general, the overall risk assessment process consists of the following components:

- exposure assessment;
- hazard evaluation*;
- risk characterization.

The following passages prepared by the risk assessment consultant, Environ Corp., (Environ, 1985) summarize these three steps:

Exposure Assessment

Knowledge of the routes, magnitude and duration of exposure to environmental chemicals is the first component of risk assessment. Human exposure is assessed in terms of the dose* of chemical taken into the body. The first step is to identify significant environmental releases (e.g. the products of incineration and the physical/chemical treatment process).

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[1] A 30 year facility lifetime was used as a conservative assumption that would overestimate chemical doses likely to occur. A 20 year lifetime was assumed by the other site selection consultants.

The next step is to identify possible routes of human exposure. Three routes -- inhalation, absorption and ingestion -- exist via which humans can become exposed to contaminants in their environment. These contaminants can be present in various environmental media such as air, surface water, ground water, and soil. Through contact with these media, individuals can ingest, inhale or absorb contaminants and thus become exposed. If the concentrations of contaminants in each of these media are known, and the extent and frequency of human contact with each is known, then a human dose of each contaminant can be estimated.

Hazard Evaluation

All chemical substances, whether natural or man-made, have the potential to cause some form of biological injury, disease or death under certain conditions of exposure. The term used to describe this inherent potential is toxicity, and the purpose of the hazard evaluation phase of risk assessment is to collect and evaluate information on the inherent toxic properties of the chemicals of interest. This information may relate both to acute and chronic toxic effects. Such information can be collected from two principal sources: epidemiological* or clinical investigations, and experimental studies involving laboratory animals or other biological systems.

In addition to identifying the types of toxicity associated with a substance, it is also necessary to identify dose-response relationships. The frequency with which toxic effects appear in an exposed population (i.e. the risk) increases with increasing exposure or dose. In many cases, the types of toxic effects change as exposure increases, becoming more severe with increasing exposure. Thus, it is important to understand how the nature and magnitude or risk relate to any given dose.

A major dose-response issue is that of thresholds. A threshold dose is that which must be exceeded before a toxic effect is observed. For most chemicals there exists a level of exposure that must be exceeded in order to create a human health risk*. For these chemicals, safe levels of exposure can be established. The dose for which no adverse response is observed is called the "no-observed adverse effect level" (NOAEL*). For other chemicals, those that cause cancer, certain mathematical models* are applied to dose-response* data. These models allow prediction of low dose risks, and their application yields an estimate of cancer risk per unit of dose.

Risk Characterization

Having evaluated the inherent hazard posed by a chemical agent, and the routes, magnitude and duration of the exposure, a quantitative measure of risk may be developed. A distinction is generally made here between the way in which risk is characterized for carcinogens* and for non-carcinogens.

Risk characterization for non-carcinogens takes the form of determining the adjusted margin-of-safety (AMOS*) -- the estimate of the largest amount of chemical to which a person can be exposed which is not anticipated to result in effects divided by the actual amount of human exposure. The AMOS incorporates a safety factor applied to the "no-observed adverse response level" for chronic exposure*. The refined value is called "acceptable daily intake". Under this system, the smaller the value of the AMOS, the larger the risk. If there is virtually no AMOS, it might be concluded that many members of the exposed population are at high risk of experiencing the form of toxicity experienced at doses above the acceptable daily intake (ADI*). At a small fraction of the acceptable daily intake, it is likely that the risk is very low and may be zero, although there is no way to determine whether this is actually the case.

For carcinogens, the risk is characterized as the unit cancer risk. The risk per unit dose is multiplied by the actual daily lifetime dose experienced by people to derive an estimate of risk. In this case, an explicit risk is estimated, which takes values between zero and one. This quantitative estimate of carcinogenic risk was evaluated against a level of acceptable risk. For the purposes of this risk assessment, a value of one in a million (1×10^{-6}) additional cancers over a lifetime of exposure* was considered as the criterion for acceptable cancer risk.

b) OWMC and Risk Minimization

The most highly ranked goal of the OWMC site selection process is to ensure that the siting and operation of its hazardous waste treatment and disposal facility is carried out in a manner that minimizes potential risks to human health. Several steps have been taken to ensure that this goal is met. Efforts are being taken to encourage reduction, recycling, exchange and recovery of waste, thus minimizing the need for treatment and disposal. No matter how successful these efforts may be, there will still be wastes which ultimately must be treated and disposed of. OWMC has, therefore, proposed the use of the best-proven waste treatment and disposal technology for the facility. A range of risk minimization construction, operations and monitoring procedures has also been incorporated into the Facilities Development Process. A detailed description of the proposed facility is provided in two reports prepared by the engineering consultants, Monenco Ltd. (Monenco 1985 and Monenco 1986).

Even with the use of the best-proven waste treatment and disposal technology, emissions from the facility will occur. If exposure to these emitted chemicals take place, human health risk may be increased. Thus, the choice of site location is an important variable that must be considered in efforts to minimize human health risk from the operation of the facility. In previous stages of the site selection process, sites less suitable in terms of risk-related siting considerations were excluded. In Phase 3B, for example, areas such as floodplains or those composed of surface granular soils were excluded because they failed to provide adequate natural containment.

Although estimated risks do vary among the siting options, the incremental levels of risks associated with the OWMC facility are estimated to be extremely low. The results of the Phase 4A risk analysis, for example, indicates that all chronic risks are below 1 x 10^{-6} (one in one million). The acute risks are also very low. In most cases the AMOS (adjusted margins of safety) are greater than one. In those instances where AMOS were less than one, the risks are very infrequent and/or mitigable (Environ, 1985). The levels of risks estimated are also based on a series of conservative assumptions regarding such matters as the toxicity of contaminants, the severity of events, the proximity of receptors and the duration of exposure. As a result, the magnitude of public health risk predicted will likely exceed that actually expected to occur.

c) Predicted Risks in Context

All human activities carry some degree of risk. Many risks are known with a high degree of accuracy because data have been collected on their historical occurrence. Table 4.1 lists the risks of some common activities. The risks listed in Table 4.1 encompass both voluntary and involuntary exposure.

4.3.3 RISK FACTOR RANKING APPROACH

This section details the methodology employed to rank the risk factors. It addresses the general assumptions and the role of the generic risk assessment. It also details the criteria employed to rank factors. Finally, it presents the factor ranking steps.

a) Assumptions

Factors are placed into a series of ranking levels. The following assumptions pertain to the establishment of the factor ranking levels:

TABLE 4.1

Risks of Death From Voluntary and Involuntary Exposures[1]

Source of Exposure	Average Annual Risk of Death[a]
Accidental Risks of Death[b]	
o all home accidents	1.1×10^{-4}
o lightning	5.0×10^{-7}
o fire arms (accidents)	1.0×10^{-5}
o motor vehicle accidents	2.4×10^{-4}
o electrocution	5.3×10^{-6}
Cancer Risks from Radiation Exposure[c]	
o background radiation exposure (average U.S. sea level)	2.0×10^{-5}
o frequent airline passenger - 4 hours/week (cosmic rays)	1.0×10^{-5}
o excess cancer risk due to living in masonry buildings rather than wood (cosmic rays)	5.0×10^{-6}
o average medical diagnostic x-ray	2.0×10^{-5}
Cancer Risks from Common Carcinogens	
o person sharing room with smoker	1.0×10^{-5}
o 1 pint of milk/day (aflatoxins)	2.0×10^{-6}
o 1/2 lb. charcoal broiled steak/week (cancer only, heart attack etc. extra)	3.0×10^{-7}
o average smoker (cancer only) (all effects)	1.2×10^{-3} 3.0×10^{-3}
o all cancers	2.8×10^{-3}

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[1] Environ, 1985.

[a] All statistics based on U.S. data.

[b] Accidental risks represent a value estimated for 1977 and 1978, based on a sequence of several years.

[c] Excess risk of cancer not distinguished from death since the difference is smaller than the uncertainty in the risk value.

Source: E.A.C. Crouch and R. Wilson, "Inter-Risk Comparisons"; Assessment and Management of Chemical Risks; eds. J.C. Rodricks and R.G. Tardiff from A.C.S. Symposium Series 239, 1984.

- Factor ranking has been undertaken to facilitate the comparative evaluation process. Distinctions have, therefore, only been drawn to the extent necessary to undertake siting option rankings;

- Ranking one factor at a higher ranking level than another factor does not indicate how much more important that factor is than the other. The magnitude of differences between ranking levels is explored in factor application (see Chapters 5 to 7);

- The factor ranking process builds upon the indicator and factor rankings undertaken by the individual site selection consultants;

- Major areas of uncertainty regarding the relative ranking of factors are explored in subsequent sensitivity analyses (see Chapter 8 of this report);

- Parallel factors with comparable characteristics and which tend to be mutually reinforcing, are generally ranked at the same level;

- Risk and impact factors are ranked separately using different criteria.

b) Role of the Generic Risk Assessment

The generic risk assessment assumed an important role in the factor ranking process. The generic risk assessment provided OWMC with a better understanding of the relative importance of human health risks. It assisted in ranking the risk factors and contributed to the basic acceptability analysis. The generic risk assessment was designed to provide quantitative estimates of public health risks associated with emissions of toxic pollutants from the proposed hazardous waste treatment and disposal facility. The term "generic" indicates that the risk assessment used a single set of generalized site parameters applicable to all sites rather than characteristics specific to each candidate site. This approach is appropriate at the level of detail used in the comparative evaluation of sites.

The pathways selected for consideration in the generic risk assessment were those with the potential to contribute most significantly to public health risk, those addressing specific public concerns and those which lent themselves to a quantitative analysis of risk. The pathways selected included the following:

1. Exposure resulting from normal facility operations:

    a) direct inhalation of air pollutants;

    b) ingestion of contaminated drinking water from ponds and cisterns;

    c) consumption of contaminated crops;

    d) consumption of contaminated meat from livestock which ingested chemical contaminants in their food and water;

    e) consumption of contaminated milk from livestock which ingested chemical contaminants in their food and water.

2. Exposures resulting from facility upset conditions.

3. Exposures resulting from facility accidents.

4. Exposures resulting from transportation spills as a result of accidents.

Each of the selected pathways is associated with specific air emissions from the facility or from a transportation spill caused by an accident. The surface and ground water pathways and transportation accidents (but resulting in spills) were not addressed in the generic risk analysis. Insufficient detailed data on the potential leachate quality from the landfill were available. Site-specific hydrogeologic data were also not available to incorporate the ground water pathway into the generic risk analysis. Detailed site-specific hydrogeologic information will only be available in Phase 4B after a more detailed drilling program has been completed. Detailed data on the potential leachate quality from the landfill will only be available after the facility has been operating for a period of years. The qualitative hydrogeologic analysis undertaken by Gartner Lee Associates (GLAL, 1985b) is, however, adequate for factor ranking, basic acceptability, and siting option comparison purposes.

Similarly, detailed site-specific information regarding surface water characteristics and quality on site and along access roads are not available. In the case of on site spills into surface water, such potential occurrences are mitigable through facility design and operations. As with the ground water pathway analysis, the surface water pathway analysis is adequate for factor ranking, basic acceptability and siting option comparison purposes.

Transportation accident risks and non-accident related spill risks are analyzed quantitatively by M.M. Dillon - Transportation (M.M. Dillon Ltd., 1985b). As a result, further investigations by the risk consultants were not required.

c) Risk Factor Ranking Criteria

Four criteria were chosen to rank the risk factors. A description of each of these criteria is included below:

1. Severity of Risk

Severity refers to both the magnitude of the risk created by exposure and the nature of the illness produced. For example, a cancer risk of one in one million (1×10^{-6}) is clearly more severe than a risk of one in one hundred million (1×10^{-8}). Likewise, irritation of the nasal passages is clearly less severe than incapacitating illness or death. Therefore, each effect related to exposure can be ranked in terms of the degree of severity.

2. Frequency/Duration of Occurrence

Frequency and duration of occurrence, or the number of expected events over a given time period, is another variable considered in ranking the acute risk factors. Some emissions that produce adverse health effects are episodic in nature. They occur with a greater or lesser frequency depending on the nature of the event being considered. For example, incinerator scrubber failure may occur more frequently than a tank farm fire. In the case of emissions that are episodic, the frequency of occurrence is an important variable to consider in factor ranking. The duration of the event also varies for acute risks, (e.g. duration of scrubber failure vs. duration of a transportation spill). Duration of occurrence was also considered in factor ranking.

3. Mitigation Potential

Mitigation potential refers to the potential for risk reduction by:

- Preventing the event. The facility can, for example, be designed and operated in a manner such that the potential for risks resulting from flooding can be essentially avoided.

- Preventing human exposure after the event occurs. With some indirect routes of exposure, such as bioaccumulation in crops and livestock, it may be possible, although very difficult, to take remedial action after the event has occurred but before human exposure takes place. One can, for example, restrict the sale of certain produce for consumption if that food stock will unacceptably increase human health risk.

- Reducing the severity of human health consequences. Contingency plans for rapid spill responses and notifications can significantly reduce the risks posed by exposure to chemical spills during transportation, particularly where exposure is caused by contamination of surface water.

There are however events, especially those involving direct inhalation as a result of chronic emissions, where mitigation cannot be assured.

4. Public and Agency Input

Two public workshops were held by OWMC in the summer of 1985. Participants in the workshops included interested individuals, groups and organizations. A total of 74 people took part in the workshops.

Copies of Volumes 1 and 2 of the Background Materials for the Phase 4A Workshops were distributed prior to the workshops (OWMC, 1985b and 1985c). The participants were asked to review the preliminary risk and impact factor rankings prepared by the site selection consultants and to provide their input and response to these rankings.

The results of these workshops, as well as any other input received from the public by individual consultants were reviewed and considered in the factor ranking process.

One meeting was also held for government representatives to review the preliminary factor rankings. The 39 attendees included representatives of provincial ministries, federal departments, provincial agencies, conservation authorities and municipal governments.

Table B.8 in Appendix B lists the changes made to ranking of risk factors based on public input.

d) Risk Factor Ranking Steps

As illustrated in Figure 4.4, the formulation of an overall ranking of risk factors occurred in four steps. First, the factors addressed by the generic risk assessment were ranked. Within these factors chronic risks were considered separately from acute. The factors for which a risk assessment was not undertaken were then ranked within risk pathways (step 2). In step 3, the chronic and acute rankings from step 1 were combined. In the final step (step 4), the preliminary factor rankings from the generic risk assessment were combined with those for the other factors. Table B.9 in Appendix B outlines the application of each criterion to the risk factors.

Public and agency review of the combined factor ranking then took place. The site selection consultants reviewed the suggestions made. Changes to factor rankings were then made.

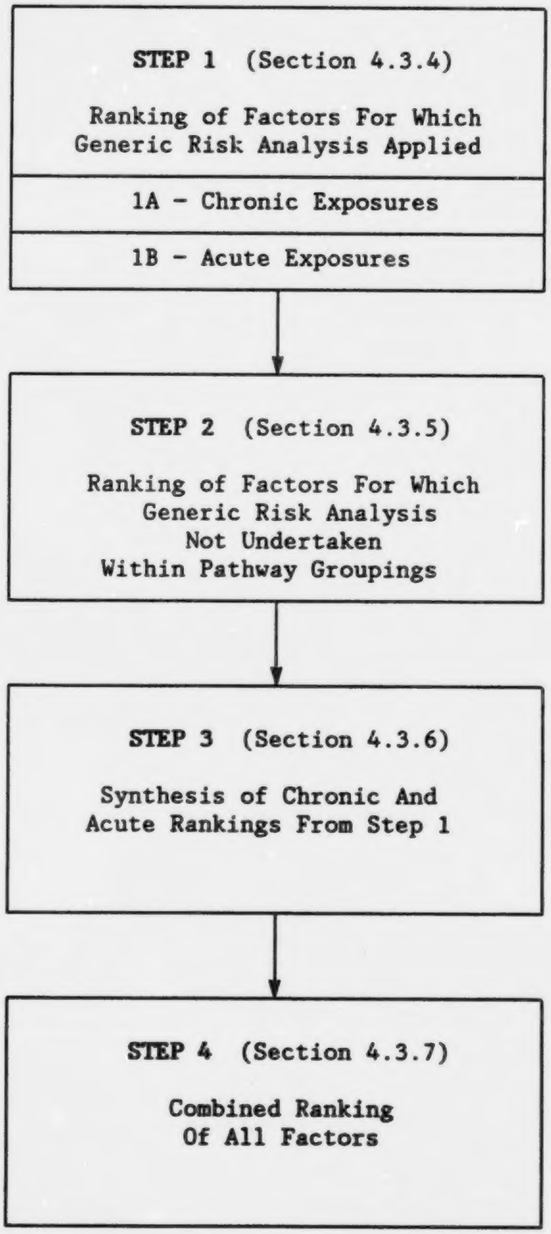
Throughout the factor ranking process, judgements were made based on technical input from the generic risk assessment and the site selection consultants' work. In order to test the importance of these judgements in the overall ranking of siting options, sensitivity analyses using alternative rankings were subsequently undertaken (see Chapter 8).

Each of the four steps involved a series of paired comparisons between various risk factors. The differences between the factors are highlighted with summary tables. Distinctions are drawn on the basis of severity, frequency and mitigation potential. The comparisons within each step and the steps themselves progressively built towards an overall ranking of risk factors.

The following sections 4.3.4 to 4.3.7 describe the steps undertaken to rank the risk factors.

FIGURE 4.4

Application of Risk Factor Ranking Criteria


STEP 1 (Section 4.3.4)
Ranking of Factors For Which Generic Risk Analysis Applied
1A - Chronic Exposures
1B - Acute Exposures
STEP 2 (Section 4.3.5)
Ranking of Factors For Which Generic Risk Analysis Not Undertaken Within Pathway Groupings
STEP 3 (Section 4.3.6)
Synthesis of Chronic And Acute Rankings From Step 1
STEP 4 (Section 4.3.7)
Combined Ranking Of All Factors

4.3.4 STEP 1 - RANKING OF FACTORS FOR WHICH THE GENERIC RISK ANALYSIS WAS APPLIED

The generic risk assessment was applied to chronic air emissions, acute air emissions sources and transportation spills. Ranking of these factors was divided into three substeps:

1. direct vs. indirect chronic exposure risks;[1]
2. chronic exposures - cisterns and ponds vs. crops and livestock;
3. acute exposures* - acute emissions vs. transportation spill.

a) Chronic Exposures to Air Emissions - (Direct vs. Indirect)

Direct vs. Indirect Emissions

Table 4.2 contains the results of the risk analysis regarding chronic exposures.

Table 4.3 contains a comparison of direct versus indirect exposures based on the criteria-severity, frequency and mitigation. Greater importance is attached to direct inhalation factors over the indirect. Severity is greater and mitigation potential is more limited for direct inhalation.

TABLE 4.2

Estimates of Lifetime Cancer Risk for Chronic Exposure

Exposure Pathways	Fugitive Emissions	Stack Emissions
Direct Inhalation	1×10^{-6}	9×10^{-7}
Ponds and Cisterns	2×10^{-8}	2×10^{-7}
Crops	4×10^{-8}	2×10^{-7}
Livestock - Beef	7×10^{-11}	2×10^{-7}
Livestock - Milk	5×10^{-11}	1×10^{-7}

Environ, 1985[2]

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[1] For purposes of this report, "direct" is defined as any exposure which humans contract without choice or warning (ie. air is direct versus meat, milk or water which are indirect).

[2] Changes were made to values subsequent to the completion of the Generic Risk Assessment Report (for changes see Environ, 1985).

TABLE 4.3

Ranking of Risk Factors

Comparison: Chronic Air Exposures (Direct vs. Indirect)

CHRONIC AIR EMISSIONS - DIRECT INHALATION			CHRONIC AIR EMISSIONS - INDIRECT EXPOSURES (Crops and Livestock, Cisterns and Ponds)			
SEVERITY	FREQUENCY	MITIGATION	SEVERITY	FREQUENCY	MITIGATION	DISCUSSION
° cancer is health injury of concern ° higher severity: 1×10^{-6} [1] for fugitive emissions and 9×10^{-7} for stack emissions	° not applicable to chronic emissions	° little potential for mitigation	° cancer is health injury of concern ° lower severity: varies from 1×10^{-7} to 7×10^{-11}	° not applicable to chronic emissions	° higher potential for mitigation by monitoring contaminant levels and remedial actions	° public input indicated that direct and indirect air emissions exposures should be ranked equally; but greater importance attached to direct inhalation pathways over indirect based on severity and mitigation criteria

---

[1] Potential for 1 in one million additional cancers over a lifetime of exposure

Indirect (Cisterns and Ponds vs. Crops and Livestock)

A further distinction is drawn among indirect factors particularly with regard to fugitive emissions.

Table 4.4 contains a comparison of chronic exposure to air emissions from cisterns and ponds and crops and livestock. Cisterns and ponds are ranked slightly higher based on the severity criterion.

b) Acute Exposures

Table 4.5 contains the results of the generic risk assessment for acute exposures. Two factors are addressed - risk from direct inhalation of emissions, which includes three events, and transportation spill risk for local and regional roads.

TABLE 4.5

Risk Estimates for Acute Exposures[1]

Source of Release	Duration of Exposure	AMOS
1. Risk from direct inhalation of acute air emissions		
Tank Farm Fire	2.6 hours	0.02
Mixing of Incompatible Wastes	42 min.	27
Incinerator Stack Scrubber Failure	2 min.	
- Sulfur dioxide		0.06
- Nitrogen oxides		2
- Hydrogen chloride		0.5
- Hydrogen fluoride		10
2. Transportation Spill resulting from a Motor Vehicle Accident	1 hour	0.01

---

[1] Changes in values occurred subsequent to the completion of the Generic Risk Assessment Report (for changes see Environ, 1985).

TABLE 4.4

Ranking of Risk Factors

Comparison: Chronic Exposures (Cisterns and Ponds vs. Crops and Livestock)

CISTERNS AND PONDS			CROPS AND LIVESTOCK			
SEVERITY	FREQUENCY	MITIGATION	SEVERITY	FREQUENCY	MITIGATION	DISCUSSION
° higher potential severity (2×10^{-7} for stack emissions and 2×10^{-8} for fugitive emissions)	° not applicable to chronic exposures	° no difference - some potential for mitigation	° lower potential severity for ingestion of livestock meat or milk (fugitive emissions) - severity is 7×10^{-11} and 5×10^{-11}	° not applicable to chronic emissions	° no difference - some potential for mitigation	° based on the severity criterion, risks from ingestion of cistern and pond water are ranked slightly higher than risks from consumption of crops and livestock; lower value for risk from consumption of livestock for fugitive emissions (Environ, 1986) ° no distinction between these factors made in public input to factor ranking

Table 4.5 shows that both acute factors have AMOS values less than one. One is the threshold value of concern (i.e. less than one is a concern).

Acute Air Emissions

The generic risk analysis of acute health pathways suggests that the following distinctions among the acute emissions pathways can be made:

- Mixing of Incompatible Wastes

  The situation which produces the least concern is the mixing of incompatible wastes. The AMOS value calculated for this accident condition is 27, which is significantly greater than the threshold value of concern (1) (Environ, 1985).

- Scrubber Failure

  In the case of the incinerator scrubber failure, although the AMOS values are less than 1, application of criteria for establishing short term public limits indicates that no adverse health effect would result. Slight odour or minor, reversible irritation effects might, however, be experienced. Information on frequency of scrubber failure events is limited, although they are expected to occur more frequently than the tank farm fire or transportation spill events. Mitigation potential is limited by the short duration of the upset condition (2 minutes) which, however, contributes to the minor nature of the effects experienced by an exposed population. (Environ, 1985).

- Tank Farm Fire

  The tank farm fire analysis applied in the generic risk analysis was premised on the release of methylene chloride as was the transportation spill accident. In this case, too, the AMOS value is significantly less than 1, and consideration of short-term public limits similarly suggests that potentially severe health effects could be experienced at the point of maximum exposure. No data are available on the frequency of such an event, although the probability is believed to be extremely low. As with the spill event, the potential for mitigation exists such that emergency response to the fire situation or evacuation may reduce the period of exposure. The tank farm fire can thus be considered to pose a concern similar to that of the transportation spill since both have the potential for significant adverse health effects, their frequency of occurrence is expected to be low, and there is the potential to mitigate against their effects. (Environ, 1985).

The mixing of incompatible wastes with an AMOS value of 27 is clearly the least significant acute emission pathway. The scrubber failure pathway is also of relatively minor significance in view of the lack of adverse health effects. The much greater severity of potential effects associated with the tank farm fire is, therefore, the controlling event in the comparison of risks from direct inhalation of acute air emissions.

Transportation Spills

The generic risk assessment reviewed the potential risk associated with spills of methylene chloride during transportation on local and regional access roads. For the transportation spill caused by motor vehicle accident, the AMOS value is significantly less than 1. Consideration of short term public limits for assessing adverse health effects suggests that potentially severe health effects could be experienced at the point of maximum exposure. Transportation-related spills, however, are expected to occur infrequently. The predicted spill frequency for health threatening spills is low (one spill every 33.6 to 653.5 years for local and regional roads)[1]. In addition, the potential for mitigation exists so that the severity of health impact predicted as a result of transportation spills resulting from accidents can be reduced from that predicted by the generic risk assessment. For example, if rapid emergency response to a spill event occurs, the period of exposure can be reduced, thus reducing the potential for adverse health impact. Therefore, while certain transportation spill events are capable of causing significant adverse health effects, the frequency at which they occur is low and there is some potential to mitigate against their effects (Environ, 1985).

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[1] Some additional risks exist that are not associated with spills resulting from motor vehicle accident events (e.g. mechanical failures). However, this scenario was not viewed to be the most conservative and therefore was not reviewed in the generic risk analysis. Non-accident related spills were part of the analysis conducted by the transportation consultant.

Based on the results of the generic risk assessment, ranking of the two acute risk factors is based on a comparison of the tank farm fire for acute air emissions and the transportation spill.

Tank Farm Fire vs. Transportation Spill

Table 4.6 contains the comparison of the two factors - risk from direct inhalation (as represented by the tank farm fire) and a transportation spill (on a local and regional access road). The arguments in Table 4.6 favour ranking the transportation spill factors slighly higher than the risk from direct inhalation-acute events factor based on frequency and mitigation potential.

There were some counter arguments which suggest that the two events be ranked at the same level. These arguments include the following:

- The potential does exist for further diminishing the risks associated with transportation spills through, for example, vehicle design requirements, vehicle operating requirements, driver training requirements, and contigency planning measures. Thus, there would appear to be mitigation potential for both events.

- The severities of the two events, as reflected in the AMOS values are essentially equivalent.

TABLE 4.6

Ranking of Risk Factors

Comparison: Acute Emissions (Tank Farm Fire vs. Transportation Spill)

TANK FARM FIRE			TRANSPORTATION SPILL			
SEVERITY	**FREQUENCY**	**MITIGATION**	**SEVERITY**	**FREQUENCY**	**MITIGATION**	**DISCUSSION**
• no preference • potentially severe (AMOS is significantly less than 1), although not sufficient to cause death or incapacitating illness	• lower risk frequency • relatively low frequency and tank farm fire is considered as hypothetical "worst case" such that event would be extremely rare	• greater potential for mitigation because greater ability to control and monitor on-site conditions and less variability in conditions • buffer area and potential land use controls off-site (e.g. voluntary purchase program for adjacent residents) provide protection • potential for occurrence could be diminished further through design, operation and contingency measures	• no preference • potentially severe (AMOS is 0.01), although largely reversible effects	• higher risk frequency • relatively low frequency, but there have been examples of transportation spills of hazardous wastes	• minor potential for mitigation • less potential to control and monitor off-site conditions and greater "lag time" involved in transporting emergency equipment and personnel • no buffer area and land use control potential is low • greater variability in off-site conditions	• transportation spill ranked more highly than acute emissions based on frequency and mitigation considerations • acute emissions events also ranked lower by public

The frequency and mitigation potential differences provide an adequate basis for distinguishing between the two events. The transportation spill is, therefore, ranked more highly than the acute events' factor.

c) Results of Step 1

The results of Step 1 are as follows[1]:

- Direct inhalation (chronic emissions) > Indirect exposure (chronic emissions)
- Cisterns and Ponds (indirect exposure) > Crops and Livestock (indirect exposure)
- Transportation Spill > Acute Air Emissions

4.3.5 STEP 2 - RANKING OF FACTORS NOT APPLIED IN THE GENERIC RISK ASSESSMENT (Within Pathway Grouping)

In this step the remaining factors not addressed by the generic risk assessment are compared within factor groupings. Six risk factors were applied in siting option comparison that were not part of the generic risk assessment. There were two hydrogeology factors, two surface water factors and two transportation accident factors. In order to rank the factors within the transportation factor grouping, local and regional spills and accidents are compared against province-wide spills and accidents.

The second step is divided into a series of substeps. These substeps include the following:

---

[1] Where: > means "is considered to be more important than"

a) hydrogeology - natural containment vs. ground water use;
b) surface water - susceptibility to flooding vs. surface water use;
c) transportation - local and regional spills and accidents vs. province-wide spills and accidents;
d) transportation - spills vs. accidents.

a) Hydrogeology - Capability of Providing Natural Containment vs. Ground Water Use

Two hydrogeologic factors are considered - capability of providing natural containment and impacts on ground water use. Table 4.7 contains a comparison of these two factors. Ground water use is less important then natural containment based on severity, frequency, potential for mitigation and the interaction between natural containment and ground water use.

b) Surface Water - Susceptibility of Site to Flooding vs. Surface Water Use

Two surface water factors are considered: susceptibility of site to flooding and potential for surface water use interference. Table 4.8 contains a comparison of these two factors based on factor ranking criteria.

Surface water use interference represents a more severe risk with a greater frequency of occurrence and a lower mitigation potential than susceptibility to flooding. The surface water use factor is, therefore, ranked higher than the susceptibility of the sites to flooding factor.

TABLE 4.7

Ranking of Risk Factors

Comparison: Hydrogeology (Natural Containment vs. Ground Water Use)

CAPABILITY OF PROVIDING NATURAL CONTAINMENT			IMPACT ON GROUND WATER USE			
SEVERITY	FREQUENCY	MITIGATION	SEVERITY	FREQUENCY	MITIGATION	DISCUSSION
• interconnected with ground water use, i.e. severity of ground water use effects dependent on degree of natural containment provided • some risk of illness and/or cancer assumed because of uncertainties regarding leachate quality and transport	• interconnected with ground water use • contaminant travel from facility to potential receptor (aquifer) depends on natural containment provided by site • contaminant travel times vary considerably, but even where containment times are long, uncertainty remains regarding the potential to contain contaminants and frequency of release	• less potential for mitigation • possible to mitigate during operations and initial post-closure period, but not over long-term	• severity of potential effect dependent on natural containment provided	• all sites involve some use of ground water, but level of concern dependent on degree of natural containment and facility design characteristics • frequency and magnitude of use difficult to control and can change over time	• greater mitigation potential by providing alternative water source • dilution available in aquifer will reduce potential effects	• ground water use less important based on severity, frequency, potential for mitigation and the interdependence between natural containment and ground water use • no public input was received regarding the relative ranking of these two factors

TABLE 4.8

Ranking of Risk Factors

Comparison: Surface Water (Susceptibility of Site to Flooding vs. Surface Water Use)

SUSCEPTIBILITY OF SITES TO FLOODING			POTENTIAL FOR SURFACE WATER USE INTERFERENCE			
SEVERITY	FREQUENCY	MITIGATION	SEVERITY	FREQUENCY	MITIGATION	DISCUSSION
° no preference ° potentially severe effects if release of untreated waste into watercourse and direct human consumption	° lower frequency because engineering measures can control on-site releases, therefore, upset events only	° greater potential for mitigation ° considered mitigable to extent potential for flooding exists	° no preference ° potentially severe effects if release of untreated waste into watercourse and direct human consumption	° very low because of potential for on-site containment through engineering measures, but some uncertainty regarding potential for release through ground/surface water connection	° potential for mitigation by monitoring of water quality, notification of users prior to exposure, dilution, and provision of alternative supplies; however, potential for ground/surface water connection releases contributes to greater uncertainty regarding engineering mitigation and notification of users prior to exposure	° surface water use interference represents a more severe risk with greater frequency of occurrence and a lower mitigation potential due to ground/surface water connections ° two separate factors not ranked independently by public workshop participants

c) Local and Regional Spills and Accidents vs. Province-Wide Spills and Accidents

The transportation system considered in Phase 4A is comprised of two major segments:

1. a province-wide segment linking the waste source areas to the major exits off the provincial freeway system approaching the site; and

2. a local and regional access system linking the freeway system to the sites and linking the sites in the case of partially integrated siting options.

In the case of both spills and accident involvements, there is the issue of whether these two segments should be ranked equally or if one segment should be ranked higher than the other. Local and regional access routes are ranked higher than the province-wide system (M.M. Dillon Ltd., 1985b). Table 4.9 contains the arguments for this conclusion:

d) Transportation - Spills vs. Accidents

In the case of the transportation factor grouping, there is also the question of whether risks due to spills (motor vehicle accident related and non-motor vehicle accident related) or risks due accident involvements should be ranked higher. The question pertains to both the province-wide system factors and the local and regional access route factors.

There are arguments which favour either position. It could, for example, be argued that risks due to accident involvements should be ranked higher than risks due to spills because the severity is greater (injury and death) with accidents than for spills, and the frequency of occurrence of accidents resulting in severe consequences is greater.

Alternatively, it could be argued that in the case of accidents, the risk to the drivers is a voluntary risk. Such is not the case with

TABLE 4.9

Ranking of Risk Factors

Comparison: Transportation (Local and Regional Spills and Accidents vs. Province-Wide Spills and Accidents)

LOCAL AND REGIONAL ROAD SPILLS AND ACCIDENTS [1]			PROVINCE-WIDE SYSTEM SPILLS AND ACCIDENTS [2]			DISCUSSION
SEVERITY	**FREQUENCY**	**MITIGATION**	**SEVERITY**	**FREQUENCY**	**MITIGATION**	
° potentially more severe effects because: - people and sensitive uses are closer - greater level of pedestrian, school bus and agricultural traffic - some more severe accidents (i.e. head-on collisions, intersectional collisions)	° greater concern regarding frequency of risk because: - OWMC traffic tends to be higher proportion of total road traffic - function of roads is less consistent with haulage of dangerous goods and wastes - lower design standards	° evacuation more difficult on local and regional roads because residents are closer and access directly to local and regional roads	° less severe effects expected because of generally greater setback of areas although population centres may be larger along province-wide access system, certain types of accidents will be more severe due to higher operating speed and the number of road users is greater for the province-wide access system	° frequency less because of design standard of province-wide access system ° OWMC facility located in the "Golden Horseshoe" should reduce overall accident rate in the province because special wastes are known to be moving over a wide variety of roadways to treatment sites in Sarnia, Blainville, Quebec, New York State, etc. ° however, relative frequency of spills is higher for province-wide system	° slightly greater mitigation potential	° local and regional roads perceived to be greater concern than province-wide by public ° local and regional access routes ranked higher than province-wide access routes based on severity, frequency, mitigation and public input criteria

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[1] Links freeway system to the sites and links the sites themselves in partially integrated cases

[2] Links the waste sources to the major exits off the provincial freeway system

hazard-based spills and local residents. It could also be argued that spills are likely to represent a greater perceived risk on the part of residents along the access routes.

The difference in risk severity and frequency (which favours a higher ranking for accidents) offsets the differences in the nature and distribution of spills and accidents (which favours a higher ranking for spills). Table 4.10 contains the two sets of arguments.

On the basis of the above, spills and accident involvements are ranked at the same level. This conclusion pertains to both the province-wide access system and the local and regional access system.

e) Results of Step 2

The results of Step 2 are as follows:

Capability of providing natural containment > Ground water use

Surface water use > Susceptibility of flooding

Spills on local and regional access routes > Spills on province-wide access system

Spills ≃ Accidents[1]

4.3.6 STEP 3 - COMBINING ACUTE AND CHRONIC FACTOR RANKINGS FOR WHICH GENERIC RISK ASSESSMENT WAS APPLIED

In Step 1, the most highly ranked acute event (of those addressed by the generic risk assessment) is spills on local and regional access roads.

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[1] ≃ is ranked at approximately the same level

TABLE 4.10

Ranking of Risk Factors

Comparison: Transportation (Spills vs. Accidents)

TRANSPORTATION SPILLS			TRANSPORTATION ACCIDENTS			
SEVERITY	FREQUENCY	MITIGATION	SEVERITY	FREQUENCY	MITIGATION	DISCUSSION
° severity of effects is less, but AMOS value is less than one (potentially severe health effect) ° direct risks to local residents	° frequency of spills is less than frequency of accidents (1 every 5.1 to 7.5 years for human health threatening spills versus 1.6 to 2.6 per year for human health threatening accidents for total access system) ° risk to residents due to spills is not voluntary ° frequency of spills is dependent on accident rates for access route	° no difference in mitigation potential	° greater severity of effects (injury and death)	° frequency of accidents is greater than frequency of spills ° risk is voluntary for contracted drivers ° risk to local residents is minor	° no difference in mitigation potential	° risk due to accidents is higher based on severity and frequency, but this is offset by the nature (voluntary for accidents versus involuntary for spills) and distribution (direct risk to local residents for spills) of spills and accidents, and their effects ° frequency of spills and accidents partially overlap (i.e. some accident involvements result in spills) and, therefore, factors are to some extent mutually reinforcing; therefore, ranking of options based on spills and accidents are very similar ° based on above points, the spill and accident factors are ranked equally ° no distinction between these factors made in results from public workshops regarding factor ranking

Direct emission - chronic are ranked higher than exposure through ingestion of cistern and pond water and consumption of crops and livestock.

In this step, the acute and chronic pathways addressed by the generic risk assessment are ranked. Two substeps are involved in this ranking process:

1. hazard-based spills on the local and regional access system vs. direct inhalation of emissions - chronic;
2. direct inhalation of emissions - acute vs. direct inhalation of emissions - chronic.

In both cases, the difficult tradeoff is made between a low severity risk with limited mitigation potential (direct inhalation of emissions - chronic) as against a high severity risk with low probability and some mitigation potential (local and regional access system spills and direct inhalation of emissions - acute).

a) Hazard-Based Spills - Local and Regional Access Roads vs. Direct Inhalation of Emissions - Chronic

Table 4.11 contains the arguments comparing direct inhalation (chronic emissions) and spills on local and regional roads based on factor ranking criteria.

Spills on the local and regional access road system are ranked more highly than the direct inhalation of emissions - chronic.

b) Direct Inhalation of Emissions - Acute vs. Direct Inhalation of Emissions - Chronic

Table 4.12 contains the arguments comparing these two factors.

TABLE 4.11

Ranking of Risk Factors

Comparison: Hazard Based Spills (Local and Regional Access Roads) vs. Direct Inhalation (Chronic Emissions)

DIRECT INHALATION (CHRONIC EMISSIONS)			HAZARD BASED SPILLS (LOCAL AND REGIONAL ROADS)			
SEVERITY	FREQUENCY	MITIGATION	SEVERITY	FREQUENCY	MITIGATION	DISCUSSION
• lower severity • long-term, very low increased risk of cancer • results in an increased risk of cancer (1×10^{-6}), but based on conservative assumptions so that in reality risk will likely be lower (see Environ, 1985) • low level of risk, lower than many risks commonly faced by people and well within provincial emissions standards	• continuous exposure at very low levels	• greater mitigation potential • limited potential for mitigation, but greater control on-site than along access routes	• severity higher (AMOS value is less than 1)	• low relative frequency (1 every 13 years to 1 every 277 years for human health threatening spills), but may occur during life of the facility	• lower mitigation potential • limited opportunity for control and less control along access routes than on-site	• spills on local and regional access system ranked higher because of greater potential severity and uncertainty regarding consequences, low probability, but potentially unacceptable risk and lower potential for mitigation • transportation risk also ranked higher than air quality risks at public workshops

TABLE 4.12

Ranking of Risk Factors

Comparison: Direct Inhalation of Emissions (Acute vs. Chronic)

DIRECT INHALATION (ACUTE EMISSIONS)			DIRECT INHALATION (CHRONIC EMISSIONS)			
SEVERITY	FREQUENCY	MITIGATION	SEVERITY	FREQUENCY	MITIGATION	DISCUSSION
• potentially severe (AMDS much less than 1) for tank farm fire and scrubber failure	• relatively low frequency and are considered as "worst case" events such that potential for occurrence is extremely low	• higher degree of control and mitigation through design, operations and contingency planning	• long-term, very low increased risk; lower than many risks commonly faced by people and well within provincial standards • risk potential is based on conservative assumptions so that in reality the risk will likely be lower than 1×10^{-6} (Environ, 1985)	• continuous low level exposure	• limited potential to improve operations and reduce emissions levels because of uncertainty regarding long-term effects and difficulties in emissions reduction	• chronic emissions ranked higher than acute emissions because acute events are based on conservative assumptions and frequency of occurrence is extremely low versus long-term, low probability of increased risk of cancer for chronic exposures • there is also a greater degree of control and mitigation for acute events • public input supported factor ranking

Chronic emissions are ranked higher than acute emissions risk. Because the study areas for the two types of releases overlap somewhat, they may turn out to be mutually reinforcing in some of the siting option comparisons rather than the basis for a difficult tradeoff.

c) Results of Step 3

The following are the results of Step 3:

Spills on local and regional access system	>	Direct inhalation of emissions (chronic exposure)
Chronic exposure	>	Acute exposure

4.3.7 STEP 4 - OVERALL RANKING OF RISK FACTORS

The result of Steps 1 through 3 are summarized in Table 4.13. The first three steps resulted in a ranking of factors within factor groupings. Two rankings between the transportation and air factor groupings were also undertaken. In Step 4, all the risk factors are combined into an overall factor ranking. Step 4 consists of three substeps:

1. completing the ranking of transportation and air factors;

2. combining the hydrogeology factors with the transportation/air factors;

3. combining the surface water factors with the transportation/air/hydrogeology factors.

TABLE 4.13

Results of Steps 1 - 3[1]

TRANSPORTATION

Local and Regional Spills > Province-Wide Spills **(Step 2)**

Local and Regional Accidents > Province-Wide Spills **(Step 2)**

Local and Regional Spills ≃ Local and Regional Accidents **(Step 2)**

Province-Wide Spills ≃ Province-Wide Accidents **(Step 2)**

HYDROGEOLOGY

Natural Containment > Ground Water Use **(Step 2)**

SURFACE WATER

Surface Water Use > Flooding Potential **(Step 2)**

AIR

(Step 3) Chronic Direct > Acute Direct

(Step 2) Cisterns and Ponds > Crops and Livestock

TRANSPORTATION/AIR

Local and Regional Spills > Direct Acute **(Step 1)**

Local and Regional Spills > Direct Chronic **(Step 3)**

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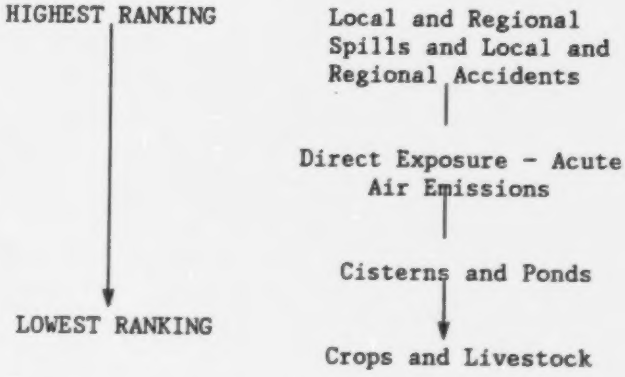
[1] > ranked higher than (considered to be more important)
≃ ranked at same level

a) Completing the Ranking of Transportation and Air Factors

The combination of these two factor groupings into a single ranking has already been partially undertaken in Steps 1 through 3. As a result of Steps 1 through 3, the partial ranking of the transportation and air factors are as follows:

FIGURE 4.5

Ranking of Transportation/
Air Factors After
Steps 1 to 3


HIGHEST RANKING
LOWEST RANKING
Local and Regional Spills and Local and Regional Accidents
Direct Exposure - Acute Air Emissions
Cisterns and Ponds
Crops and Livestock

Step 2 established that province-wide spills and province-wide accidents are ranked at the same level. It also determined that this level should be lower than local and regional spills and accidents. The question remaining is where the province-wide spills and accidents should be ranked in reference to the four air factors.

Province-Wide Spills and Accidents vs. Cisterns and Ponds and Crops and Livestock

Table 4.14 contains a comparison of province-wide spills and accidents versus indirect air emissions exposures. Province-wide spills and accidents are ranked higher than cisterns and ponds and crops and livestock based on severity, frequency and mitigation potential.

TABLE 4.14

Ranking of Risk Factors

Comparison: Province-Wide Spills and Accidents vs. Indirect Exposures (Cisterns and Ponds and Crops and Livestock)

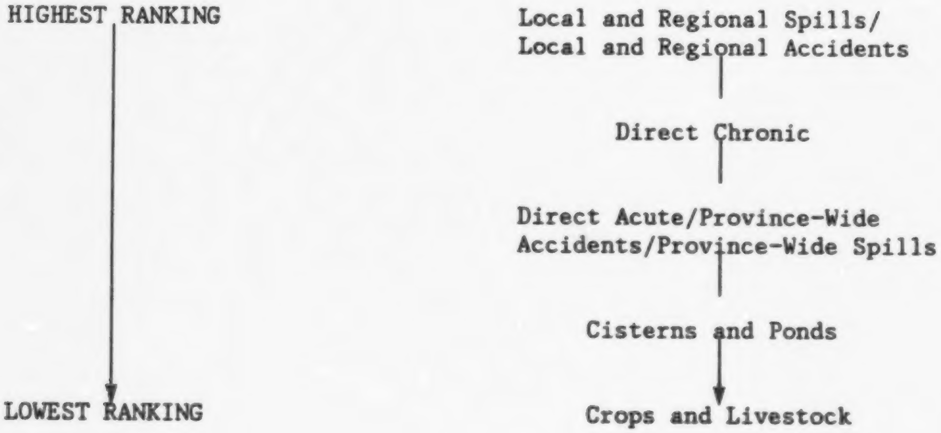
PROVINCE-WIDE SPILLS AND ACCIDENTS			INDIRECT EXPOSURES (CISTERNS & PONDS & CROPS & LIVESTOCK)			DISCUSSION
SEVERITY	FREQUENCY	MITIGATION	SEVERITY	FREQUENCY	MITIGATION	
• potentially more severe effects (injury and death)	• frequency of event is very low, but potential for event during lifetime of facility	• potential for mitigation prior to health effects is less assured because off-site mitigation has less control than on-site	• severity of risk is lower (1 x 10^{-7} and lower risk of cancer)	• chronic exposure to low level of emissions	• greater potential for mitigation on-site where control is direct and greater potential to mitigate indirect exposures	• province-wide accidents and spills ranked higher for severity, and mitigation criteria and low probability but potentially unacceptable risk • ranking was supported by public input

Province-Wide Spills and Accidents vs. Direct Inhalation (Chronic Emissions) and Direct Inhalation (Acute Emissions)

The characteristics of province-wide spills closely parallels direct acute emissions. In the case of both direct acute and province-wide spills and accidents, potential effects are severe, mitigation is possible but not assured and frequency is low. Province-wide spills and accidents are therefore ranked at the same level as direct inhalation - acute. The resultant factor ranking is illustrated in Figure 4.6.

FIGURE 4.6

Ranking of Air/Transportation Risk Factors


HIGHEST RANKING
LOWEST RANKING
Local and Regional Spills/
Local and Regional Accidents
Direct Chronic
Direct Acute/Province-Wide
Accidents/Province-Wide Spills
Cisterns and Ponds
Crops and Livestock

b) Combining the Hydrogeology Factors with the Air and Transportation Factors

Natural Containment

Adding the hydrogeology factor to the overall ranking involves some very difficult tradeoffs. Hydrogeology - natural containment is a highly ranked factor.

The major reasons for this conclusion include the following:

- A failure to provide natural containment could result in relatively severe effects; leachate quality is of concern;
- Mitigation of inadequate natural containment cannot be assured. Containment cannot be assured in the long-term at either the engineered landfill or the physical/chemical treatment plant/incineration plant. It is not possible to ensure that attenuation or dilution will be effective in the long-term. It is also not possible to assure alternative ground water supplies can be provided in the long-term.
- There is a considerable variability in the capability of different sites to ensure natural containment, with some sites providing quite limited natural containment.
- Natural containment is an important agency and public concern.

In light of the above, hydrogeology natural containment is first compared to the most highly ranked air/transportation factors.

Natural Containment vs. Local and Regional Spills and Accidents

The comparison between spills and accidents on local and regional roads and hydrogeology - natural containment reveals comparable levels of severity, frequency/duration and mitigation potential (see Table 4.15):

There is no clear preference between the hydrogeology - natural containment and the spills - local and regional access system factors. Siting preferences can only be established on the basis of site-specific comparisons.

TABLE 4.15

Ranking of Risk Factors

Comparison: Natural Containment vs. Local and Regional Access Routes Spills and Accidents

CAPABILITY OF PROVIDING NATURAL CONTAINMENT			LOCAL AND REGIONAL ACCESS ROUTES SPILLS AND ACCIDENTS			
SEVERITY	FREQUENCY	MITIGATION	SEVERITY	FREQUENCY	MITIGATION	DISCUSSION
• no preference • potentially severe health risk; indirect pathway, but leachate quality uncertain and containment is variable	• no preference • exposure during operating life of the facility is unlikely, but long-term effectiveness of planning and engineering measures cannot be assured	• no preference • mitigation not assured because of uncertainties regarding flow patterns and hydrogeologic conditions	• no preference • severe health risk; direct pathway (injury and death)	• no preference • low probability, but may occur during the life of the facility	• no preference • mitigation not assured because not possible to fully control off-site vehicles	• there is no clear preference between the options based on severity, frequency or mitigation; both options are highly ranked public concerns (ranked first and second at public workshops)

Natural Containment vs. Direct Inhalation (Chronic Emissions)

Hydrogeology - natural containment is ranked higher than direct inhalation - chronic exposure for the reasons contained in Table 4.16.

Ground Water Use vs. Indirect Air Pathways (Cisterns and Ponds and Crops and Livestock)

Ground water use is ranked higher than the indirect air pathways. The major reasons for this conclusion are contained in Table 4.17.

The factor ranking resulting from the inclusion of the hydrogeologic factors in the overall ranking is illustrated in Figure 4.7.

FIGURE 4.7

Ranking of Transportation, Air and Hydrogeology Risk Factors

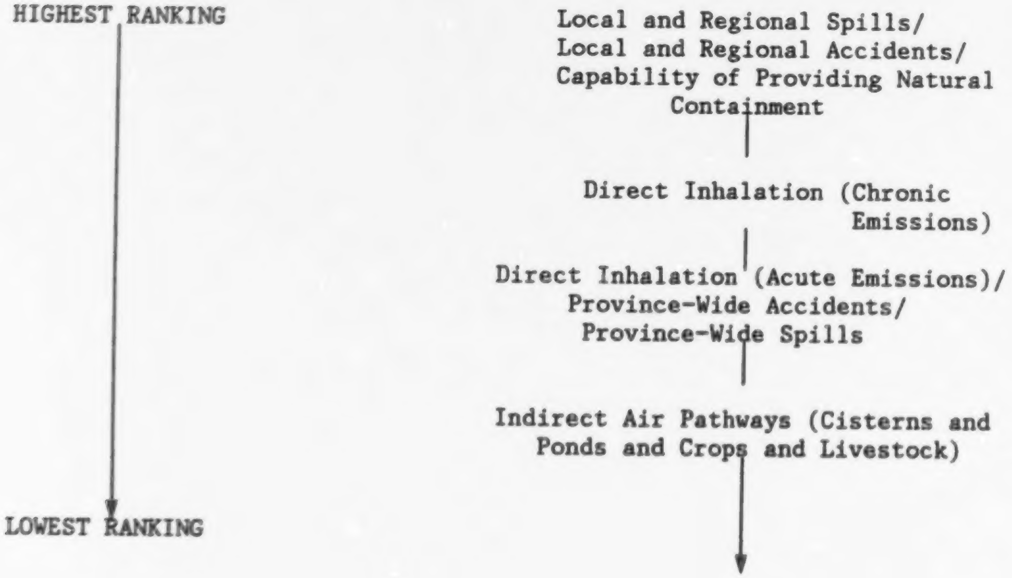

HIGHEST RANKING
LOWEST RANKING
Local and Regional Spills/ Local and Regional Accidents/ Capability of Providing Natural Containment
Direct Inhalation (Chronic Emissions)
Direct Inhalation (Acute Emissions)/ Province-Wide Accidents/ Province-Wide Spills
Indirect Air Pathways (Cisterns and Ponds and Crops and Livestock)

TABLE 4.16

Ranking of Risk Factors

Comparison: Natural Containment vs. Direct Inhalation (Chronic Emissions)

CAPABILITY OF PROVIDING NATURAL CONTAINMENT			DIRECT INHALATION (CHRONIC EMISSIONS)			
SEVERITY	FREQUENCY	MITIGATION	SEVERITY	FREQUENCY	MITIGATION	DISCUSSION
• higher severity • potentially severe health risk; uncertainty regarding leachate quality	• longer frequency • exposure during operating life of the facility is unlikely, but long-term effectiveness after closure cannot be assured	• no preference • mitigation not assured	• lower severity • long-term, very low increased risk of cancer; though based on conservative assumptions	• lower frequency • continuous low level exposure for life of facility	• no preference • limited opportunity to improve operations and reduce emissions levels	• natural containment is ranked higher than direct inhalation - chronic emissions because of potentially severe risks and long duration of potential risk associated with capability of providing natural containment • ranking supported by public input

TABLE 4.17

Ranking of Risk Factors

Comparison: Impact on Ground Water Use vs. Indirect Exposure to Air Emissions

IMPACT ON GROUND WATER USE			INDIRECT EXPOSURE TO AIR EMISSIONS (Crops and livestock, Cisterns and ponds)			
SEVERITY	**FREQUENCY**	**MITIGATION**	**SEVERITY**	**FREQUENCY**	**MITIGATION**	**DISCUSSION**
° greater potential severity because of limited natural containment for some sites	° longer potential exposure period (beyond operations)	° mitigation is possible, but more difficult and would have to extend over a longer period of time	° lower severity of risk; even when conservative assumptions are used (at least one order of magnitude less than 1×10^{-6})	° shorter potential exposure period (operating period of facility only)	° higher potential for mitigation by monitoring contaminant levels and remedial actions	° indirect air pathways less important based on severity, frequency and mitigation potential ° higher ground water risk ranking supported by public input

c) Combining the Surface Water Factors with the Transportation/Air/Hydrogeology Factors

The two surface water risk factors were potential for surface water use interference and susceptibility of site to flooding.

Surface Water Use vs. Natural Containment

Surface water use interference is secondary in importance to capability to provide natural containment. Table 4.18 contains a comparison of these factors. Surface water use is less important than natural containment based on severity and frequency.

Ground Water Use vs. Surface Water Use

Ground and surface water use are ranked at the same level because of the potential ground/surface connections and the comparable levels of severity and mitigation potential.

Flooding Potential

As previously noted, for all candidate sites flooding potential was reduced as a result of boundary refinement. Any release of contaminants as a result of flood can be avoided by design and operations. In addition, monitoring of water quality, notification of users, dilution and alternative water supplies can be used to mitigate surface water flooding risk should a release occur. In light of the above, flooding potential is ranked as the least important factor.

d) Overall Ranking of Factors

The overall risk factor ranking resulting from the inclusion of the surface water factor is highlighted in Table 4.19.

TABLE 4.18

Ranking of Risk Factors

Comparison: Surface Water Use Interference vs. Natural Containment

SURFACE WATER USE INTERFERENCE			CAPABILITY OF PROVIDING NATURAL CONTAINMENT			
SEVERITY	**FREQUENCY**	**MITIGATION**	**SEVERITY**	**FREQUENCY**	**MITIGATION**	**DISCUSSION**
° no preference ° potentially severe effects	° dependent on ground/surface water connection which is related to capability to provide natural containment	° mitigation of flooding is possible, but greater uncertainty with respect to releases related to ground/surface water connection	° no preference ° potentially severe effects	° frequency varies with contaminant breakthrough times	° mitigation is possible during facility operation, but not over long-term	° capability to provide natural containment is more important because of the ground/surface water connection; surface water use risks dependent upon capability to provide natural containment ° ranking supported by public input

TABLE 4.19

Final Ranking of Risk Factors

STUDY AREA	FACTOR GROUPING	FACTORS	RANK
	A. RISK		
	° Transportation	° annual province-wide hazard-based spill index of OWMC generated transport	8
		° annual province-wide accident involvements of OWMC generated transport	8
		° transportation risks on local and regional access roads due to accident involvements of OWMC generated transport	10
		° transportation risks on local and regional access roads due to hazard-based spills of OWMC generated transport	10
	° Air Quality	° risk from direct inhalation of emissions - chronic	9
		° risk from direct inhalation of emissions - acute	8
		° risks from ingestion of cistern and pond water	6
		° risks from consumption of crops and livestock	5
	° Hydrogeologic Suitability	° capability to provide natural containment	10
		° ground water use	7
	° Surface Water Suitability	° susceptibility of site to flooding	3
		° potential for water use interference	7

In order to reflect the differences in the rankings, a 10-level ranking system is used. No attempt is made to specify the magnitude of differences between levels, although the flooding potential factor is placed at a level 3 (rather than a level 4) to reflect the relatively minor role envisioned for this factor.

The ranking of risk factors involves a number of difficult judgements. Further judgements are necessary to address the question of the magnitude of differences among ranking levels. Analyses to test the sensitivity of the siting option rankings to alternative factor rankings have been undertaken and are documented in Chapter 8 of this volume.

4.4 IMPACT FACTOR RANKING

4.4.1 INTRODUCTION

There are a total of 54 impact factors. These factors are grouped in three different ways:

a) by study area - site, site vicinity, access roads, community and regional;

b) by factor grouping - residents, businesses, community and recreation features, natural environment, land use, agricultural resources and community and regional;

c) by discipline - social, economic, agriculture, land use, biology, municipal finance, air quality.

This portion of the chapter details the impact factor ranking process.

4.4.2 IMPACT FACTOR RANKING APPROACH

a) Assumptions

The following assumptions were employed in the ranking of impact factors:

- factors are only ranked to the extent necessary for comparative purposes;
- the factor rankings build upon the work already undertaken by the individual consultants;
- parallel factors with comparable characteristics, and which are mutually reinforcing, are ranked at the same level;
- the study areas are not ranked independently of each factor. Rather the importance of each study area is implicit in the factor rank.

b) Impact Factor Ranking Criteria

Nine criteria were selected to facilitate impact factor ranking. These criteria are briefly described below:

- Potential for Impacts - Factors possessing a strong likelihood for the occurrence of an impact are ranked more highly. With some factors the likelihood of impacts occurring are relatively remote. The transportation analysis, for example, indicates that the likelihood of spills is extremely remote. The likelihood of spills into watercourses, such that fish communities are adversely affected, is even more remote. In such cases the factors are not ranked as highly. With other factors such as the displacement of people, impacts are certain and warrant a higher ranking.

- Severity of Impacts - Factors having the potential for highly negative or highly positive impacts are ranked more highly. With some factors, the severity of potential impacts is either quite low for all siting options or represents a very minor change from existing or anticipated conditions. Such is the case, for example, with potential impacts on Provincial Planning Areas such as the Parkway Belt West Plan. None of the siting options are located in the Parkway Belt West Planning Area and the establishment of the facility in relatively close proximity to the Planning Area does not appear to conflict with the policies and objectives of the Parkway Belt West Plan. In such cases the factors are not ranked highly.

  Alternatively, with the disruption of residents adjacent to site factor, impacts could be quite severe as a result of noise, dust, visual intrusion, traffic and property value depreciation. In such cases the factors are ranked highly.

- Public Policy Concern - Factors are ranked more highly if there is a potential conflict with provincial or municipal policies. The potential for public policy conflict is not a consideration with some factors. There is, for example, no directly applicable public policy for the social cohesion factor.

  With other factors, as with the proposed and planned land use factor, there are a wide range of directly relevant public policies expressed in local and regional official plans. Such factors are ranked more highly.

- Significance - More significant features and uses are ranked more highly, irrespective of impact severity. Significance pertains to the importance of a feature or resource within the region or community. Significance encompasses such considerations as rarity, sensitivity to change, and major agency or community concerns. Provincially rare animal species, are considered highly significant. They are, therefore, ranked highly.

- Frequency/Duration - Factors representing the potential for high frequency or long duration impacts are ranked more highly.

  With some factors, impacts occur very briefly or very occasionally. Digging up archaeological resources on site, for example, will only occur during construction. With other factors, impacts will occur over the operating life of the facility. Such is the case for farms adjacent to the site. In other cases, such as the displacement of farmland, the impact represents a permanent resource loss.

- Relationships to Other Factors - Factors highly connected to other factors are ranked more highly than independent factors. With some factors, such as the displacement of historical features, impacts are not likely to result in secondary consequences and therefore, are ranked less highly. In contrast, a major adverse impact on the economic base of an area, could have a wide range of social, economic and land use repercussions. It is therefore ranked more highly.

- Certainty of Predictions - Factors are ranked more highly when they have the potential for serious unanticipated impacts. With some factors, such as the loss of prime farmland, potential impacts are well understood, the magnitude of potential impacts can be predicted with a considerable degree of accuracy, and the magnitude of impacts anticipated is considered moderate. With other factors, such as economic stability, impact predictions are less precise. Such predictions are dependent on external considerations which can either not be controlled or which may change during the construction or operations phases. Thus, land value changes in the vicinity of some sites may either be short-term and moderate or they may be long-term and severe. In cases where there is the potential for serious unanticipated impacts the factor is ranked more highly.

Factors are ranked lower when there is limited confidence in their value for decision-making purposes. Such factors might, for example, provide only a limited and indirect sense of the nature and magnitude of changes which might occur as a result of the establishment of the facility. Such factors are considered to be of supplementary importance to factors which provide more precise and direct estimates of OWMC induced changes.

- Mitigation - Non-mitigable factors are ranked more highly. With some factors potential impacts can be readily mitigated. Such is the case for the displacement of archaeological resources on site. Any archaeological resources identified on-site will either be avoided or excavated in an appropriate manner prior to site development.

  With other factors, such as land value changes, there is only the potential for mitigation. With still other factors, such as the loss of farmland, mitigation is not possible.

- Public and Agency Input - As for risk factors, public input provided at the two OWMC public workshops and through discussions with individual consultants has been incorporated into the ranking of impact factors (see p. 26, Chapter 4).

  Table B.8 in Appendix B lists the changes made to ranking of impact factors based on public input.

c) Grouping of Criteria

The nine criteria are grouped into three categories - magnitude, importance and tempering considerations.

- Magnitude, in this context, encompasses consideration of the likelihood of the effect occurring at all (potential for impact), the severity of negative or highly positive impacts which could potentially take place (severity), the potential duration and frequency of impacts (duration/frequency), and the potential for synergistic effects (relationship to other factors). Magnitude treats the range of impacts across the siting options collectively. It compares them to existing conditions and to other types of intrusions. Thus, magnitude treats impacts in an absolute sense.

- Importance pertains to the significance of the feature or resource represented by the factor irrespective of the magnitude of potential impacts. Importance is interpreted from three perspectives - a technical perspective (as reflected in the significance criterion), an agency perspective (public policy concern) and a public perspective (public input).

  As with the magnitude category, importance is interpreted in an absolute sense in that the siting options are treated collectively and compared to features and resources elsewhere in the candidate region.

- Tempering Considerations pertain to criteria having the potential for increasing or reducing the magnitude of potential impacts or the importance of features or resources. Two criteria are encompassed by this category - mitigation potential and uncertainty.

Tables B.10 to B.12 in Appendix B document the application of the nine impact ranking criteria to the factors.

d) Impact Ranking Steps

The factor ranking process for the impact factors began with the individual site selection consultants. Each site selection consultant ranked the factors for which they were responsible. In documenting their reasons for ranking consideration was given to the factor ranking criteria described in the previous section. Table B.13 in Appendix B lists the consultants' rankings. The rationale for these rankings is documented in the consultant's individual reports.

As illustrated in Figure 4.8, the formulation of an overall ranking of impact factors takes place in four steps. In Step 1 (Section 4.4.3), the most important factors are identified. Relative importance distinctions within this grouping are then drawn.

In Step 2 (Section 4.4.4), the clearly lowest importance factors are identified. Again, distinctions are drawn within this grouping of factors.

Step 3 (Section 4.4.5) involves an analysis of the remaining intermediate ranked factors. Relative importance distinctions are then drawn.

The final step, Step 4 (Section 4.4.6), involves a cross-check to confirm that the most highly ranked factors of those identified in Step 1 (factors of greatest importance) are indeed more important than the highest ranked factors analyzed in Step 3 (intermediate factors). Step 4 also involves a cross-check to confirm that the least ranked factors analyzed in Step 3 (intermediate factors) are indeed more important than the highest ranked of the factors considered in Step 2 (lowest ranked factors).

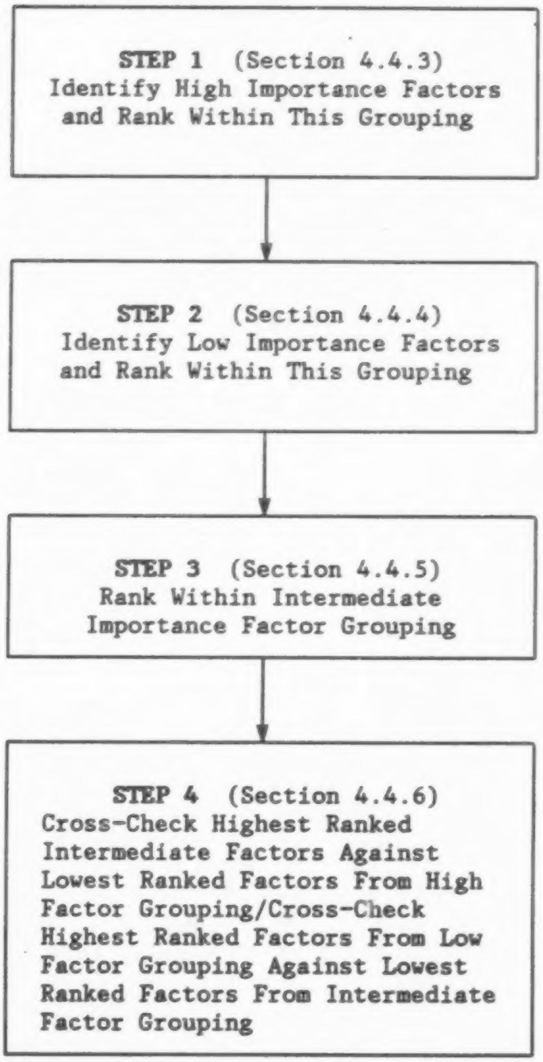
The outcome of this process is 10 factor ranking levels. These ranking levels only signify the relative importance of factors. They do not address the magnitude of difference between levels.

Public input is considered explicitly in the ranking of impact factors. The importance of the impacts is partly dependent on the public perceptions of the importance of impacts. Therefore, public input formed a component of the "importance category". In addition, changes have been made to impact factor rankings based on input provided by the public. Table B.8 in Appendix B lists changes made to the preliminary factor ranking based on public input.

The following sections 4.4.3 to 4.4.7 describe the steps involved in ranking of impact factors.

FIGURE 4.8

Steps in Impact Factor Ranking



STEP 1 (Section 4.4.3)
Identify High Importance Factors and Rank Within This Grouping

STEP 2 (Section 4.4.4)
Identify Low Importance Factors and Rank Within This Grouping

STEP 3 (Section 4.4.5)
Rank Within Intermediate Importance Factor Grouping

STEP 4 (Section 4.4.6)
Cross-Check Highest Ranked Intermediate Factors Against Lowest Ranked Factors From High Factor Grouping/Cross-Check Highest Ranked Factors From Low Factor Grouping Against Lowest Ranked Factors From Intermediate Factor Grouping

4.4.3 STEP 1 - IDENTIFY HIGH IMPORTANCE FACTORS

The highly ranked factors represent factors of greatest importance in the siting option comparison. Reasons for placing factors in the top factor grouping are listed in Table 4.20. In general, factors placed in the top factor grouping potentially result in severe impacts. They also represent sensitive or significant uses or resources where the identified impacts are not offset by tempering considerations.

A total of 17 factors satisfy the reasons listed in Table 4.20. They include the following:

Site

- Displacement of residents;
- Rare species*.

Site Vicinity

- Disruption of day-to-day activities and/or the use and enjoyment of property (adjacent);
- Disruption of adjacent farm operations;
- Disruption of day-to-day activities and/or the use and enjoyment of property (non-adjacent);
- Disruption of non-adjacent farm operations;
- Partial displacement of farms;
- Existing land use.

Community and Regional

- Stability of farm population;
- Social stability;
- Community character;
- Stability of agricultural land base;

TABLE 4.20

Reasons for Placing Impact Factors in the Top Grouping

Criteria	Reasons
Magnitude	
o Potential for impact	o expected to occur or will occur
o Severity of impact	o potentially severe or serious impacts
o Frequency/duration	o long-term, very frequent or permanent
o Relationship to other factors	o highly interconnected
Importance	
o Significance	o highly sensitive or significant
o Public input	o ranked highly by the public
o Public policy concern	o represents direct conflict with public policy
Tempering Considerations	
o Mitigation	o not mitigable or limited mitigation possible
o Certainty of predictions	o confidence in data or interpretation adequate to recognize serious adverse consequences
	o potential for further serious, unanticipated impacts

- Community and regional economic base;
- Disruption to the farm economy;
- Tourism economy.

Access Roads

- Disruption of day-to-day activities and/or the use and enjoyment of property (adjacent);
- Disruption of farm traffic and cattle crossing.

The major reasons why these factors are placed in the high ranking grouping are summarized in Table B.14 in Appendix B.

The basis for distinguishing among factors within the high ranking factor grouping is summarized below. The differences among the three levels largely pertain to degrees of magnitude, importance and the potential for mitigation, as well as to the level of certainty of the impact predictions.

a) Level 10 Factors

Two factors - disruption of day-to-day activities and/or the use and enjoyment of property (adjacent) and disruption of adjacent farm operations are ranked at level 10.

In both cases, direct and potentially serious impacts of long duration are possible. Adjacent residents and farm operations are most important because direct impacts such as noise, visual change, disruption of lifestyle and community are expected to be greatest near to the sites. In addition, mitigation and compensation may not be as great as for on-site. Impacts on adjacent residents and farm operations are significant agency and public concerns.

b) Level 9 Factors

Five factors are slightly less important than those ranked as 10. Four of these factors have the same characteristics as those ranked in the highest category except that the magnitude of impacts is expected to be slightly less. These factors include displacement of residents, disruption of day-to-day activities and/or the use and enjoyment of property (non-adjacent to site), disruption of non-adjacent farm operations and partial displacement of farms and stability of farm population.

Each of these factors:

1. has potentially serious impacts but slightly less than for adjacent receptors;
2. has direct, indirect and long-term impacts;
3. has a high certainty of impacts occurring;
4. has a high level of interrelationship with other factors, but not as high as for site - adjacent impacts on residents and farm operations;
5. is not fully mitigable;
6. has relatively high uncertainty, but the potential for serious unanticipated consequences;
7. has high public and agency concern, but not as high as for adjacent impacts.

The fifth factor, ranked 9 (stability of farm population), has slightly different characteristics. Although impacts are expected to be limited and medium term, there is a high level of uncertainty regarding potential unanticipated serious impacts. In addition, stability of farm population is of high importance/significance relative to other factors. It also has a wide range of interconnections to other factors. Consequently, it is also ranked at level 9.

c) Level 8 Factors

The remaining ten factors are ranked at level 8. They include:

- rare species (site);
- existing land use (site vicinity);
- disruption of day-to-day activities and/or the use and enjoyment of property (adjacent to access roads);
- disruption of farm traffic and cattle crossings;
- regional and community economic base;
- disruption to the farm economy;
- tourism economy;
- social stability;
- community character;
- stability of agricultural land base.

A number of these factors are similar in that they relate to regional and community impacts. Social stability, community character, stability of agricultural base, disruption to the farm economy and tourism economy all have the following characteristics:

1. the potential for impacts is uncertain because it depends on individual reactions to more direct impacts such as noise and traffic change;

2. the impacts are expected to be low, but there is potential for serious, unanticipated impacts;

3. the potential effects could be long-term;

4. the potential impacts have connections to a wide range of other factors;

5. the potential for mitigation is limited;

6. there is only a moderate degree of confidence in the qualitative data.

The combination of the uncertainty regarding potentially serious unanticipated impacts and the potential interactions among other factors contribute to a level (8) ranking.

The remaining five factors are ranked at a level 8 for a variety of reasons.

The disruption of day-to-day activities and/or the use and enjoyment of property (adjacent to access roads) is similar to the same factor applied to the non-adjacent site vicinity. However, the impacts are expected to be less along access routes. Impacts will generally be intermittent. In addition, OWMC traffic along local and regional access routes represents a minor increment beyond existing and anticipated traffic volumes (M.M. Dillon, 1985a). Consequently, this factor is ranked slightly lower (8 vs. 9).

Similar levels of impact are expected for the disruption of farm traffic and cattle crossings as for residents along access routes. Moderate to high impacts are expected for the duration of the facility operation. The significance of impacts on residents and on farm operations is considered equal. Consequently, both of these factors are ranked as level 8.

Rare species (on-site) are also of high importance. As with the other highly ranked factors, potentially serious long-term impacts are possible. Mitigation may not be possible. The severity of impacts is not extremely high. Endangered species are not likely to be found on the sites. Consequently, a ranking of 8 is applied.

The regional and community economic base factor is of high overall importance (8). This factor differs from most others in that both positive and negative impacts are possible. Impacts are expected to be moderate to positive. This factor is connected to a wide range of other factors. The importance of this factor is increased by the uncertainty regarding potentially serious unanticipated impacts and by the limited opportunity for mitigation. The interconnection between the industrial/commercial economic base, the farm economy and the tourist economy is such that it is appropriate that these factors are ranked at the same level.

The final factor ranked at level 8, is existing land use (site vicinity). Existing land uses adjacent to the site are relatively important and likely to be most highly impacted. This factor pertains to the potential for direct conflict with nearby land use. The factor is important because it addresses land use compatibility in a collective sense rather than in terms of conflict with individual uses. As such, it is a useful perspective to consider in conjunction with other measures of adjacent impacts. It is also appropriate to rank this factor at a level comparable to other adjacent factors. It is, however, placed at a level 8, rather than a level 10 or a 9 to reflect its supplementary role in the comparative evaluation process.

4.4.4 STEP 2 - IDENTIFY LOW RANKING CHARACTERISTICS

The low ranking categories are assigned to factors considered of low importance in site selection. The role of mitigation is important for these factors. The importance or magnitude of impacts are in many cases, decreased by the potential for mitigation. Reasons for placing factors in the bottom impact factor grouping are listed in Table 4.21.

Eight factors satisfy the reasons listed in Table 4.21. They include the following:

TABLE 4.21

Reasons for Placing Impact Factors in Bottom Grouping

Criteria	Reasons
Magnitude	
o Potential for impact	o not expected to occur
o Severity of impact	o potentially minor and/or indirect
o Frequency/duration	o short-term or highly infrequent
o Relationship to other factors	o largely unrelated to other impacts or minor role in reinforcing other factors
Importance	
o Significance	o relatively insignificant and/or insensitive and/or readily adaptable to facility
o Public input	o ranked low by the public
o Public policy	o no conflict with public policy
Tempering Considerations	
o Mitigation	o readily mitigable and commitment to mitigate by OWMC
o Uncertainty of predictions	o limited confidence in data or interpretation such that should play a minor role in decision-making or high degree of confidence that factor should play a minor role in decision-making

Site

- land use stability.

Site Vicinity

- rare species;
- provincial policies and plans;
- fish and wildlife features of significance;
- restraints to dispersion.

Access Roads

- disruption of operations of community and recreation features (adjacent).
- disruption of operations of community and recreation features (non-adjacent).

Community and Regional

- provincial policies and plans;

The major reasons why these factors are placed in the low ranking grouping is summarized in Table B.15 in Appendix B.

The two ranking levels of low importance are 1 and 2. Level 1 factors represent very low impacts for all categories. Level 2 factors represent a slight increase in impact or a decreased potential for mitigation.

a) Level 1 Factors

Two factors are of less importance than all other factors. These factors are provincial policies and plans (community and regional) and disruption of operations of community and recreation features (non-adjacent). In both cases, the likelihood of impacts is low. The potential impacts are negligible, though potentially long-term. There is little interrelationship between these factors and others. The potential for mitigation is high. There is some uncertainty regarding the data, but little potential for serious unanticipated impacts. All of these characteristics indicate that these factors are of minor importance to decision-making.

b) Level 2 Factors

The six factors ranked as level 2 exhibit many of the characteristics of those ranked level 1. In all cases, however, they have one or two characteristics that increase their importance or magnitude of impacts. There is some potential for mitigation for these factors.

Two natural environment factors are of low importance (level 2). They are fish and wildlife features of significance (site vicinity) and rare species (site vicinity). Although, the features themselves are significant, each factor is likely to have very low or minor impacts. Mitigation, although unlikely to be required, is possible.

The "restraints to dispersion" factor is of low importance because there is a high certainty of only minimal impacts. Level 1 is not assigned because the impacts are connected to other air quality risk factors. Only limited mitigation is possible.

Disruption to the operations of community and recreation features (adjacent to access roads) is slightly more important than for non-adjacent factors (ranked 1). The potential impacts are slightly greater in magnitude. They are still minor, unlikely and potentially mitigable.

Two land use factors are of low importance - provincial policies and plans (site vicinity) and land use stability (site). The impacts on provincial policies and plans are slightly higher for the site vicinity than for the community and regional area (level 1) because slightly greater indirect impacts are possible closest to the site. The land use stability factor is supplementary to other more direct measures of potential social change. In addition, the data collected for this factor are of limited reliability for decision-making.

4.4.5 STEP 3 - IDENTIFY INTERMEDIATE RANKING CHARACTERISTICS

The remaining factors are of neither high nor low importance. For each of the nine criteria, moderate levels of impact are expected.

The differentiation of these factors into ranking levels is not as apparent as for the high and low ranking groups. The levels 3 to 7 are based upon subtle differences in factor rankings identified by the individual consultants. As such, they indicate the range of moderate impacts possible for each discipline. Table 4.22 lists the moderate factor rankings by discipline. The consultant's rank, the final rank and the rationale are provided.

4.4.6 STEP 4 - CROSS-CHECK RANKINGS

a) Cross-Check that Factor Rank 8 is Greater than Factor Rank 7

In order to ensure that the factors have been placed in the appropriate broad categories (high, medium or low), a cross-check was undertaken to compare the factor levels at the breaking points between the high, medium and low categories. In this step, the factors ranked at level 7 are reviewed to ensure that they are of lower importance than the factors ranked at level 8.

TABLE 4.22

Moderate Factor Rankings Used in Comparison of Siting Options

FACTOR/DISCIPLINE	CONSULTANTS' RANKING	FINAL RANK (1-10)	RATIONALE
Social			
o Disruption of day-to-day activities and/or the use and enjoyment of property (non-adjacent access roads)	600 (out of 1500 maximum)	7	o The type of potential nuisances are expected to be limited in comparison to those experienced by residents adjacent to access roads (IER, 1985); therefore, a lower weighting was applied. o The final rankings are proportional to the weight assigned by IER (out of 1500) (7 vs 8 by MMD and 600 vs 800 by IER)
o Tourism operations	no ranking	6	o Supplementary and of less importance than tourism economy factor (ranked 8). o Equivalent to business activities negatively affected by presence of OWMC facilities (see Economic factors ranked as 6).
o Social cohesion	400 (out of 1500 maximum)	6	o While social cohesion is considered an important factor, the data available can be used to only partially assess social cohesion because extent of voluntary out-migration is unknown. Consequently a lower weight is assigned to social cohesion than to social stability (ranked 8) (IER, 1985a).

* 10 represents greatest importance; moderate factors range from 3-7.

TABLE 4.22

Moderate Factor Rankings Used in Comparison of Siting Options

FACTOR/DISCIPLINE	CONSULTANTS' RANKING	FINAL RANK (1-10)	RATIONALE
Social			
o Disruption of operations of community and recreation features (adjacent to site)	300 (out of 1500)	5	o Due to their proximity to site, all adjacent features could be impacted. o Features adjacent to the site serve the local community and may have sensitive users; the potential impact is considered somewhat greater than displacement of features (ranked 3)
o Displacement of community, recreation and historic features	200 (out of 1500)	3	o The displacement on any siting option is minimal and mitigation will occur. o the displacement of features is judged as significantly less important than displacement or disruption of residents (ranked 8-10).
o Disruption of operations of community and recreation features (site vicinity)*	200 (out of 1500)	3	o OWMC commitment to mitigate potentially reduces importance. o It is anticipated that community and recreation features in the site vicinity will experience effects similar to, but at a lower level than, those adjacent (ranked 5).

* This factor though initially considered, was screened from the IER final analysis.

TABLE 4.22

Moderate Factor Rankings Used in Comparison of Siting Options

FACTOR/DISCIPLINE	CONSULTANTS' RANKING	FINAL RANK (1-10)	RATIONALE
Land Use			
o Planned and proposed land use (site)	25 (out of 30)	7	o Planned land use (land use designations) on-site, key to compatibility of proposed facilities with land use intentions of municipalities - may be mitigable through redesignation (LKA, 1985). o Not of high importance because future land use uncertain and mitigation is possible; therefore ranked as high-moderate factor. o All final rankings are proportional to LKA weights (out of 30).
o Planned and proposed land use (site vicinity)	25 (out of 30)	7	o Planned land uses adjacent to site, especially residential designations (constraint) and heavy industrial designations (potential opportunity) are important considerations in determining compatibility of proposed facilities with land use intentions of municipality - may be mitigable through redesignation (LKA, 1985). o Not of high importance because future land use uncertain and mitigation is possible; therefore ranked as a high-moderate factor.
o Existing land use (site)	20 (out of 30)	6	o existing land use on site, especially residential uses, very sensitive to facility impacts, but may be partially mitigated through expropriation and compensation (LKA, 1985).

TABLE 4.22

Moderate Factor Rankings Used in Comparison of Siting Options

FACTOR/DISCIPLINE	CONSULTANTS' RANKING	FINAL RANK (1-10)	RATIONALE
Land Use			
o Existing land use (community and regional)	10 (out of 30)	4	o Indirect impacts expected beyond site vicinity, but provides overview of impacts on community and regional land use pattern (LKA, 1985)
o Planned and proposed land use (community and regional)	10 (out of 30)	4	o Indirect impacts on proposed and planned land uses, but may influence future development activity in community and regional area (LKA, 1985)
o Existing land use (access roads)	10 (out of 30)	4	o Direct though relatively minor impacts of additional truck traffic on existing land uses along access roads, except where urban lands affected (LKA, 1985).
o Planned and proposed land use (access roads)	10 (out of 30)	4	o Indirect impacts on future land uses along access roads, but may have significant affect on major residential development proposals; mitigation possible through land use controls (LKA, 1985).
o Land use stability (site vicinity)	5 (out of 30)	3	o Indirect impacts; qualifies other land use impacts, though limited reliability of data (LKA, 1985).

TABLE 4.22

Moderate Factor Rankings Used in Comparison of Siting Options

FACTOR/DISCIPLINE	CONSULTANTS' RANKING	FINAL RANK (1-10)	RATIONALE
Agricultural Resources			
o Loss of farmland (site)	3 (out of 5)	6	o permanent loss of agricultural resource to society, but land loss in absolute terms is small (Ecologistics, 1985).
o Displacement of farms with on-site headquarters (site)	3 (out of 5)	6	o Potentially serious and long-term impacts on individuals but largely compensable (Ecologistics, 1985).
o Disruption to crop and livestock production (access roads)	2 (out of 5)	4	o Frequency of occurrence low, affected area small, spill could be cleaned up and compensation paid (Ecologistics, 1985).
Natural Environment			
o Potential for occurrence of other significant biological features (site)	3 (out of 5)	6	o A significant factor but must be ranked lower than rare species occurrences which are presently known (ranked 8) (GLAL, 1985a).
o Natural vegetation displaced (site)	2 (out of 5)	4	o No sites have extensive blocks of forest or other habitat types which are required for species having large territories. o Other factors deal with each species and special features (GLAL, 1985a).

TABLE 4.22

Moderate Factor Rankings Used in Comparison of Siting Options

FACTOR/DISCIPLINE	CONSULTANTS' RANKING	FINAL RANK (1-10)	RATIONALE
Natural Environment			
o Fish communities (access roads)	2 (out of 5)	4	o Real potential for and duration of impact is relatively low and mitigation measures might be applied. o Public policy concern.
Economic			
o Property value impacts	7 (out of 10)	7	o Impacts expected to be moderate. o Interconnected with other factors. o Important factor to public and agencies. o Some potential for mitigation.
o Business activities negatively affected by presence of OWMC facilities	6 (out of 10)	6	o Impacts expected to be moderate and long-term. o Connected to other factors. o Considered to be slightly less important than property value impacts because impacts on residents are perceived by public to be more important.
o Business activities positively affected by OWMC facilities	4 (out of 10)	4	o Positive impacts depend on individual reactions of business owners; therefore ranked lower than negative impacts on businesses (Clayton, 1985a).

TABLE 4.22

Moderate Factor Rankings Used in Comparison of Siting Options

FACTOR/DISCIPLINE	CONSULTANTS' RANKING	FINAL RANK (1-10)	RATIONALE
Economic			
o Displacement of businesses	2 (out of 5)	4	o The number and importance of businesses potentially displaced by OWMC is comparatively small and compensation is possible.
Air Quality			
o Existing and anticipated air quality	2.3 (out of 5)	6	o Impacts are a moderate concern. o Mitigation not possible. o May result in restraints on OWMC facility.
Archaeology			
o Archaeological resources	no ranking used	3	o Some impacts will occur but mitigation will reduce impacts. o Displacement of a permanent resource.

The disruption of day-to-day activities and/or the use and enjoyment of property (non-adjacent access roads) is clearly not a high importance factor. The impacts are expected to be limited and lower than those for activities adjacent to access roads which have been ranked at level 8.

The two planned and proposed land use factors (site and site vicinity) are also clearly not equivalent to factors ranked as at level 8. Impacts are indirect and uncertain because of the inevitable difficulties in estimating future land use. They may also be mitigated through land use control. Level 8 factors refer to impacts on existing residents and features. They are therefore more certain to occur and more difficult to mitigate.

The only other level 7 factor is property value impacts. This factor is not of high importance because impacts are expected to be moderate, of short duration and there is mitigation potential. Therefore, property value impacts do not meet the criteria for a level 8 factor.

b) Cross-Check that Factor Rank 3 is Greater than Factor Rank 2

In order for a factor to be ranked 1 or 2, the potential magnitude and importance of the impact must be very low and some mitigation must be possible. The five factors ranked 3 are reviewed against the criteria for low ranking of factors.

The displacement of community, recreation and historic features can be viewed as of low importance. Displacement will not result in permanent resource loss because of OWMC commitment to mitigate. Consequently, this factor was screened from the IER final analysis.

The potential frequency and level of disruption of operations of community and recreation features (site vicinity) factor is considered by the social consultant to be moderate. Increased sound levels, truck traffic, visual intrusion and other direct impacts are possible (IER, 1985). Consequently, this factor cannot be ranked as level 2. At level 2, impacts are expected to be minor and/or indirect and/or unlikely.

Land use stability (site vicinity) is also ranked as level 3. This factor has implications for many other social and economic factors. Consequently, it is of moderate importance.

The other natural vegetation factor represents relatively significant resources that may be susceptible to impact. Consequently, this factor is not of low importance.

Similarly, the archaeological features factor represents a significant resource that could be potentially displaced. Although significant archaeological features will be excavated before construction, thus avoiding most potential impacts, a moderate degree of importance is attached to this factor.

The ranking of impact factors involved a number of difficult judgements. Sensitivity Analyses have therefore been undertaken to test the sensitivity of the siting option rankings to alternative factor rankings (see Chapter 8).

Table 4.23 contains the final ranking of impact factors.

TABLE 4.23

Final Ranking of Impact Factors

STUDY AREA	FACTOR GROUPING	FACTORS	RANK
SITE	B. ENVIRONMENTAL IMPACTS		
	° Residents	° displacement of residents	9
	° Businesses	° displacement of businesses	4
	° Community and Recreation Features	° displacement of historical, community and recreation features	3
		° archaeological resources	3
	° Land Use	° existing land use	6
		° proposed and planned land uses	7
		° land use stability	2
	° Agricultural Resources	° displacement of farms with on-site headquarters	6
		° loss of farmland	6
	° Natural Environment	° rare species	8
		° natural vegetation displaced	4
		° potential for occurrence of other significant features	6
SITE VICINITY	° Residents	° property value impacts	7
		° disruption of day-to-day activities and/or the use and enjoyment of property (adjacent to site)	10
		° disruption of day-to-day activities and/or the use and enjoyment of property (non-adjacent)	9

TABLE 4.23

Final Ranking of Impact Factors

STUDY AREA	FACTOR GROUPING	FACTORS	RANK
SITE VICINITY (Continued)	B. **ENVIRONMENTAL IMPACTS** (Cont'd)		
	° Businesses	• business activities negatively affected by the presence of OWMC facilities	6
		• business activities positively affected by the presence of OWMC facilities	4
	° Community and Recreation Features	• disruption of operations of community and recreation features (adjacent to site)	5
		• disruption of operations of community and recreation features (site vicinity)	3
	° Land Use	• existing land use	8
		• proposed and planned land use	7
		• land use stability	3
		• provincial policies and plans	2
	° Agricultural Resources	• partial displacement of farms (off-site farms with on-site land)	9
		• disruption of adjacent farm operations	10
		• disruption of non-adjacent vicinity farm operations	9
	° Natural Environment	• Significant Environmental Units (SEUs)	4
		• fish and wildlife features of significance	2
		• other natural vegetation	4
		• rare species	2

TABLE 4.23

Final Ranking of Impact Factors

STUDY AREA	FACTOR GROUPING	FACTORS	RANK
SITE VICINITY (Concluded)	B. **ENVIRONMENTAL IMPACTS** (Cont'd)		
	° Air Dispersion/Air Quality	° restraints to dispersion	2
		° existing and anticipated air quality	6
COMMUNITY AND REGIONAL	° Community and Regional	° municipal finance	6
		° social stability	8
		° social cohesion	6
		° community character	8
		° regional and community economic base	8
		° tourism economy	8
		° tourism operations	6
	° Land Use	° existing land use	4
		° proposed and planned land use	4
		° provincial policies and plans	1
	° Agricultural Resources	° stability of farm population	9
		° stability of agricultural land base	8
		° disruption to the farm economy	8
ACCESS ROADS	° Residents	° disruption of day-to-day activities and/or the use and enjoyment of property (adjacent)	8
		° disruption of day-to-day activities and/or the use and enjoyment of property (vicinity)	7

TABLE 4.23

Final Ranking of Impact Factors

STUDY AREA	FACTOR GROUPING	FACTORS	RANK
ACCESS ROADS (Concluded)	B. **ENVIRONMENTAL IMPACTS** (Cont'd)		
	• Community and Recreation Features	• disruption of operations of community and recreation features (adjacent)	2
		• disruption of operations of community and recreation features (vicinity)	1
	• Land Use	• existing land uses	4
		• planned and proposed land uses	4
	• Agricultural Resources	• disruption to farm traffic and cattle crossings	8
		• disruption to crop and livestock production	4
	• Natural Environment	• fish communities	4

Final report

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SITE SELECTION PROCESS
PHASE 4A: SELECTION OF A PREFERRED SITE(S)
SITE SELECTION
VOLUME 2 - PART 2

June, 1986

This document consists of Part 2 (Chapters 5-9) of Volume 2 of Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Site Selection. The evaluation procedures employed in the evaluation of the six candidate siting options are documented as follows:

- Chapter 5 - Differences and Tradeoffs Synthesis;
- Chapter 6 - Synthesis of Disciplinary Perspectives;
- Chapter 7 - Quantitative Aggregation of Factors;
- Chapter 8 - Sensitivity Analyses.

Chapter 9 presents Conclusions and Recommendations. In addition a List of References, Glossary of Terms and Maps pertinent to Volume 2 are provided.

Technical appendices which accompany these five chapters are bound under a separate cover. Technical appendices C-I are bound as Volume 2 - Technical Appendices - Part 2.

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SITE SELECTION PROCESS

PHASE 4A: SELECTION OF PREFERRED SITE(S)

SITE SELECTION - VOLUME 2 - PART 2

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5.0 DIFFERENCES AND TRADEOFFS SYNTHESIS

5.1 INTRODUCTION

This chapter documents one of four procedures, the differences and tradeoffs synthesis used by the site selection team to compare and evaluate the six candidate siting options - LF-4N/PI-1N and LF-4N/PI-13N in Milton, LF-3C and LF-9C in West Lincoln, and LF-1E and LF-1E/PI-27E in Niagara Falls.

This procedure represents an extension and refinement of the paired comparisons highlighted in the OWMC Phase 4A report (OWMC, 1985c). The differences and tradeoffs synthesis, together with the disciplinary synthesis (Chapter 6) were the primary methods by which the detailed data base for the six siting options were integrated.

a) General Characteristics

The principal characteristics of the differences and tradeoffs synthesis include the following:

- the paired comparison of options, i.e. two options at a time, to minimize the amount of data and the number of choices addressed at one time;
- a staged process: 1) to identify major risks and impacts, 2) to identify major differences between pairs of options, and 3) to evaluate tradeoffs between options;

- a staged process for comparing pairs of options first within the same geographic area, i.e. Milton, West Lincoln, Niagara Falls and then between geographic areas; i.e. Milton vs. West Lincoln, Milton vs. Niagara Falls and West Lincoln vs. Niagara Falls;

- the use of data and interpretations derived from the site selection consultants' technical analyses;

- the systematic incorporation of public and agency concerns into the comparison process;

- the presentation of the synthesis by means of a series of reasoned arguments supported by data and interpretation summarized in tabular form.

Many of the arguments and tradeoffs presented in this chapter are addressed in the disciplinary synthesis - Chapter 6. An effort has been made to summarize the major points to avoid repetition. However, since the approach is quite different from that presented in Chapter 6, all the major tradeoffs are evaluated. In this way, all major arguments relevant to a comparison are included in the analyses. In addition, different perspectives and arguments bearing on particular tradeoffs are retained. However, there is the potential for different conclusions.

b) General Assumptions

The facilities characteristics assumptions employed in the Phase 4A analysis and their role in site selection are documented in Appendix A in Volume 1.

In addition to these facilities characteristics assumptions, several additional general assumptions are employed for comparative evaluation purposes. These general assumptions include the following:

- rail service is viewed as an opportunity for the bulk haulage of process additives and reagents, rather than as an absolute requirement. For comparative evaluation purposes, it is assumed that rail service is not provided to the candidate siting options;

- with the exception of PI-27E, all features on-site are displaced. With all sites, except for PI-27E, there is the possibility that features outside the operating area may be displaced by service, road or rail extensions. The central operating area of PI-27E is restricted to the area to the south of the existing ConRail line. No service, road or rail access routes would extend through the northern portion of PI-27E.

- site-specific mitigative measures are built into the paired comparison process. Mitigative measures of a policy nature are examined in sensitivity analyses and are documented in Chapter 8;

- impact assessments for the provision of off-site facility services are not included as these facilities will be largely restricted to existing rights-of-way. Such studies (e.g. electricity, raw water supply) will be conducted during Phase 4B.

c) Section Format

The subsections which follow describe:

- the three major stages in each paired comparison, 1) the identification of major risks and impacts; 2) the identification of differences; and 3) the evaluation of tradeoffs;

- the rationale for the sequence of paired comparisons.

5.1.2 PAIRED COMPARISONS STAGES

a) The Identification of Major Risks and Impacts

The paired comparisons procedure began with the identification of major risks and impacts. This stage was necessary to focus the evaluation on risks and impacts of greatest magnitude and importance.

Four considerations were employed to identify major risks and impacts:

i) measures of the relative magnitude of potential risks and impacts (as reflected in factor suitability levels);

ii) consultants' interpretations of the absolute magnitude of potential risks and impacts (as reflected in judgements and interpretations contained in the reports of the individual site selection consultants);

iii) site selection team interpretations of the importance of potential risks and impacts (as reflected in factor rankings);

iv) agency and public interpretations of the importance of potential risks and impacts (as reflected in comments and suggestions contained in submissions from and obtained through meetings with agencies and the public).

In all four cases, a conservative approach was used to identify "major" risks and impacts, i.e. if there is any doubt regarding whether a potential risk or impact should be identified as major, it was included.

i) Measures of Relative Magnitude

The consultants addressed a broad range of potential risks and impacts. Potential risks or impacts were estimated or described in a diversity of qualitative and quantitative ways. Number of farms displaced could, for example, be counted. Municipal financial impacts could also be estimated quantitatively. However, a more qualitative approach to predicting potential impacts on, for example, social stability was required. In order to compare this array of risks and impacts measured or described in different ways, it was necessary to develop a procedure which consistently reflected the range of differences across the options. The procedure employed was to ask each consultant to convert their risk and impact predictions to factor suitability levels. These factor suitability levels ranged from 0 to ±5[1]. With this procedure, 0 represents the absence of potential risks or impacts and ±5 represents the siting option with the greatest positive or negative risk or impact.

Tables C.1 to C.6 in Appendix C list the suitability levels together with the supporting rationale for each factor, for each siting option.[2]

Rather than limiting the comparative evaluation process only to potential risks and impacts with the least attractive or most attractive suitability levels (e.g. levels ±5), all potential risks and impacts with factor suitability levels of -5 to -3 and +3 to +5 were defined as major.

ii) Measures of Absolute Magnitude

In addition to relative differences in impacts or risks, it is possible that, for some risks or impacts all siting options would be constrained. Thus, any risk or impact judged "major" by a consultant was included irrespective of its factor suitability level.

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[1] The individual consultant's Phase 4A reports should be referred to for the derivation of their factor suitability levels (see List of References).

[2] As described in Chapter 7, it was necessary to make some adjustments to consultants' factor suitability levels to make them comparable. The factor suitability levels included in these tables are those that have been adjusted by Dillon Site Selection.

iii) Site Selection Team Interpretation of Importance

As detailed in Chapter 4 a 10 level system was employed by the site selection team to rank the risk and impact factors. In defining major risks and impacts, it was recognized that a somewhat lower level of negative risk or impact or higher level of positive impact might still be significant if the factors under consideration were particularly important. Thus when a predicted risk or impact involved highly ranked factors, i.e. factors at ranking levels 8, 9 or 10, the factor suitability level considered to be major was lowered from ±3.0 to -2.0 and +2.0. It was, further concluded that a potential risk or impact with suitability levels of -1.0 to -5.0 or +1.0 to +5.0 and factor ranking levels of 9 or 10, would also be considered major.

iv) Agency and Public Interpretations of Importance

In addition to the considerations noted above, agency and public concerns or issues[1] associated with each siting option were reviewed.

All concerns raised by the public and agencies which could potentially occur were considered in defining major risks or impacts. Public and agency concerns were considered in defining major risks or impacts only in cases where the factor was not already a major risk or impact based on factor ranking or magnitude of impact considerations.

Most concerns raised by the public were considered major risks or impacts. The only public concerns not considered major risks or impacts were noise impacts along access roads for non-adjacent residents (LF-1E, LF-1E/PI-27E and LF-4N/PI-1N), effects of air emissions on surface water

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[1] An issue is a major potential constraint associated with a siting option, raised through the public consultation process.

(Milton options and LF-1E/PI-27E), municipal services effects (Niagara Falls) and tourism impacts (Milton). Of those not considered major risks or impacts for a particular siting option, only effects of emissions on surface water and tourism were raised more than once (three and two times). Archaeology was not considered a major impact for any option because impacts are mitigable (public concern for Niagara Falls options and LF-3C).

Table C.7, Appendix C lists concerns raised by the public and agencies and the response to each concern in Phase 4A. This table includes a rationale for concerns not considered in Phase 4A. The table also highlights the treatment of each concern in (identifying) major risks or impacts. Table C.8 in Appendix C contains a listing of concerns raised by the public and agencies and the frequency with which they were raised. Tables C.9 and C.10 list concerns raised by the public and agencies relating to mitigation/compensation and those not related to a specific factor.

b) The Identification of Differences

The major risks and impacts of one siting option were compared with those of another siting option to identify differences between siting options. In those cases where a particular factor represented a major risk or impact for one siting option, but not for the other, data were tabulated for both siting options. These data provided the basis for examining differences between options.

A systematic procedure determined the magnitude and significance of differences between siting options. A difference was considered significant if:

- the difference between the factor suitability levels was greater than 1.0;
- the difference between the factor suitability levels was 1.0 or less, with a factor rank of 8, 9 or 10.

The approach to identifying differences is conservative. Very limited differences were included in the analysis. Any differences for highly ranked factors were included. Where there was doubt regarding whether a difference should be included, it was incorporated into the analysis.

The differences were initially tabulated by siting option pair, e.g. LF-1E vs. LF-1E/PI-27E. An indication of the magnitude and significance of differences was provided. Differences not fulfilling the above criteria were considered negligible. In such cases, the differences were screened from the analysis. Where there were no differences between factor suitability levels, those differences were also screened. Summary tables are presented on a risk pathway and an impact study area basis. These tables indicate which differences favour which siting option under study. No or negligible differences between the siting options are also noted in these summary tables. In addition to the tables, the differences between the siting options are documented in the text.

c) Evaluation of Tradeoffs

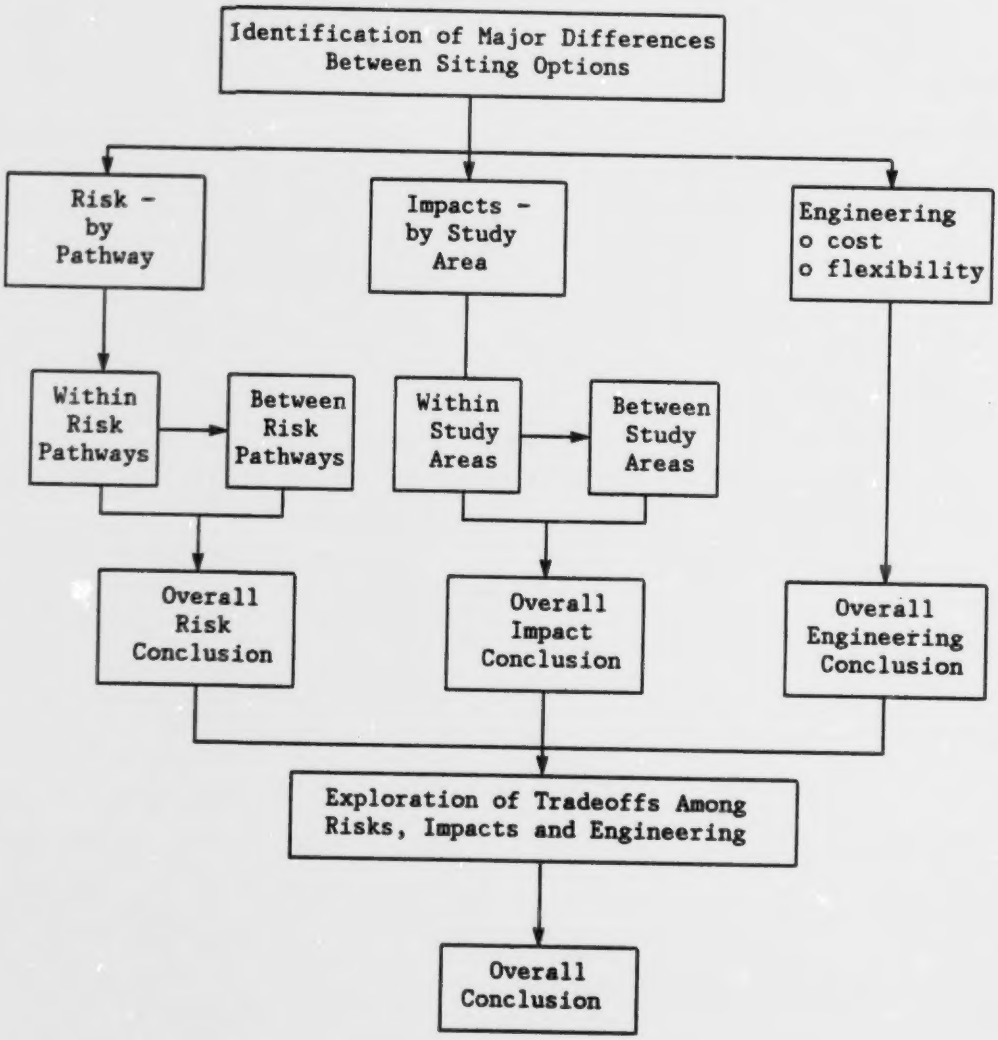
The process employed to evaluate tradeoffs is illustrated in Figure 5.1.

The identification of the major differences between the siting options is the basis for the tradeoffs evaluation. The differences favouring one siting option are "traded off" against those favouring the other siting option. A reasoned argument determines whether the differences favouring one option outweigh the differences favouring the other option. An example of a tradeoff between LF-9C in West Lincoln and LF-4N/PI-1N in Milton is the transportation risk differences favouring LF-4N/PI-1N against hydrogeologic suitability and air quality risk differences favouring LF-9C.

Risks, impacts and engineering considerations were initially examined separately in the tradeoffs evaluation. The examination of risk began with a review of the tradeoffs within risk pathways (i.e. transportation, air

FIGURE 5.1

Process Employed in the Evaluation of Tradeoffs


Identification of Major Differences Between Siting Options
Risk - by Pathway
Impacts - by Study Area
Engineering
o cost
o flexibility
Within Risk Pathways
Between Risk Pathways
Within Study Areas
Between Study Areas
Overall Risk Conclusion
Overall Impact Conclusion
Overall Engineering Conclusion
Exploration of Tradeoffs Among Risks, Impacts and Engineering
Overall Conclusion

quality, ground water, surface water). For example, within the transportation risk pathway, risk on the local and regional access road component could favour one siting option. Another siting option could be preferred for the province-wide system. Once conclusions were reached for tradeoffs within risk pathways, tradeoffs between risk pathways were examined. Likewise, the examination of impact tradeoffs began with a review of the major tradeoffs within study areas (i.e. site, site vicinity, community and regional, access roads). Once conclusions were reached for tradeoffs within study areas, tradeoffs among study areas were examined.

Engineering (i.e. capital and operating costs and engineering flexibility) differences were then reviewed. As previously described, engineering considerations played a secondary role in the paired comparison analysis. They represented tempering considerations which reinforced a preference for a particular siting option or indicated a minor area of difference between siting options.

The final step in the paired comparison approach involved the systematic evaluation of tradeoffs among risks, impacts and costs. A summary table is presented indicating the overall conclusion for each risk pathway and study area, as well as for overall risk, impacts and costs.

The evaluation of tradeoffs is based on:

- a review of the site selection consultants' data base;
- a review of the site selection consultants' positions in discussions and meetings;
- a review of the site selection consultants' interpretations contained in the Phase 4A technical reports;
- a review of mitigation or compensation measures that could potentially temper arguments;

- a review of concerns raised by agencies and the public.

In all cases, reasoned arguments are presented.

In evaluating the tradeoffs between siting option pairs, a number of basic arguments were employed. The major reasons for a preference of one siting option over another included:

- the constraints are limited for one siting option, but are substantial for the other siting option;
- the factors favouring one siting option are ranked higher than those factors favouring the other siting option;
- the magnitude of difference between the siting options is greater for one side of the tradeoff than for the other side of the tradeoff;
- the risks or impacts are mitigable or potentially mitigable for one siting option, but not for the other siting option;
- the magnitude of difference between the siting options, in absolute terms (i.e. relative to external conditions), is greater for one side of the tradeoff than for the other side;
- there is greater confidence in the data and in the certainty of severity of risk or impact for one side of the tradeoff than for the other side.

5.1.3 SEQUENCE OF PAIRED COMPARISONS

The process of comparing the siting options took place in three steps - the comparison of siting options within geographic clusters[1], the comparison of the preferred siting options from each geographic cluster and the final comparison of the two most preferred siting options. The paired comparison approach is illustrated in Figure 5.2.

The differences between siting options within the same geographic cluster are generally less pronounced than differences between siting options not within the same geographic cluster. Within the same geographic cluster, the following similarities occur:

- generally geologic, hydrogeologic and geotechnical conditions, e.g. predictability of geologic conditions, do not vary greatly;
- there is no appreciable difference in the province-wide access system; portions of the local and regional access system are shared;
- there are limited differences in existing and anticipated air quality;
- the general pattern of direct (e.g. residents) and indirect (e.g. crops and livestock) risk receptors do not vary greatly;
- downstream surface water uses are similar;
- there are no great differences in the general land use, social, economic and agricultural character of the areas;
- as the same municipalities are involved, the municipal service and finance implications do not vary greatly.

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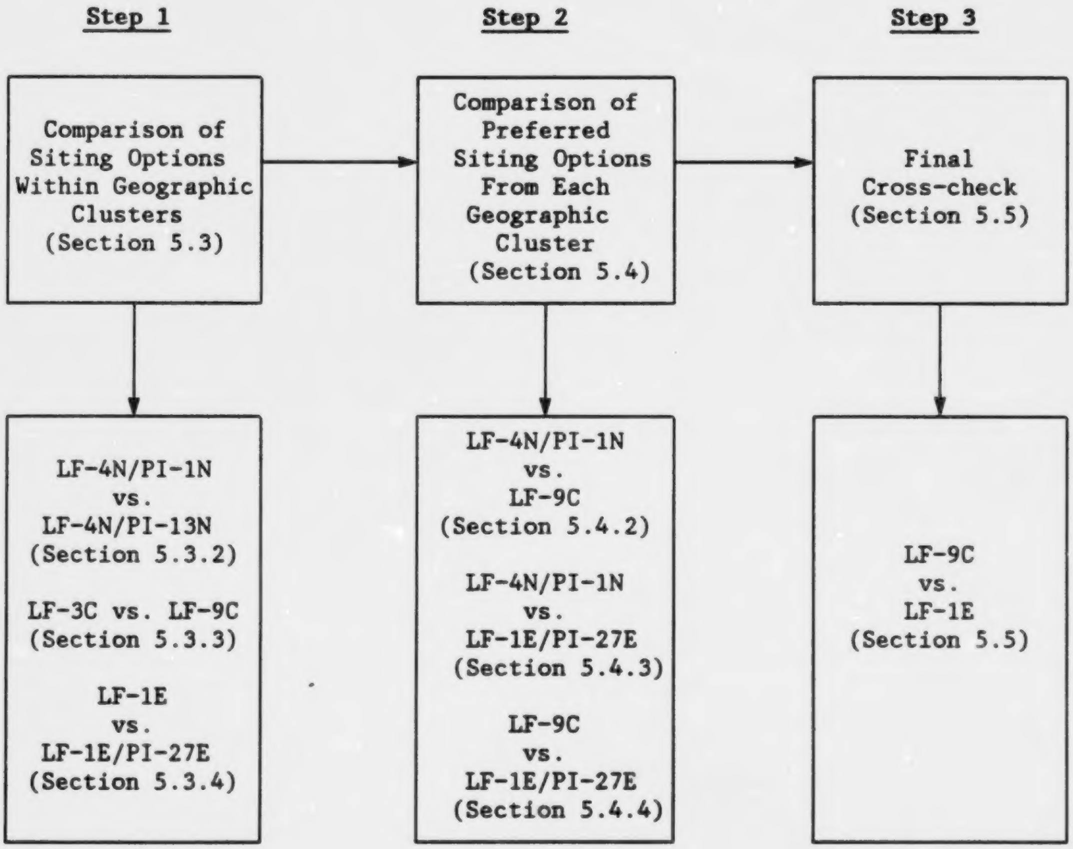
[1] Geographic cluster refers to the grouping of the siting options by location - Milton, West Lincoln and Niagara Falls, prior to the comparison of siting options. The siting options located within each geographic cluster were compared. A preferred siting option for each geographic cluster was then identified.

FIGURE 5.2

Paired Comparison Approach


Step 1
Step 2
Step 3
Comparison of Siting Options Within Geographic Clusters (Section 5.3)
Comparison of Preferred Siting Options From Each Geographic Cluster (Section 5.4)
Final Cross-check (Section 5.5)
LF-4N/PI-1N vs. LF-4N/PI-13N (Section 5.3.2)
LF-3C vs. LF-9C (Section 5.3.3)
LF-1E vs. LF-1E/PI-27E (Section 5.3.4)
LF-4N/PI-1N vs. LF-9C (Section 5.4.2)
LF-4N/PI-1N vs. LF-1E/PI-27E (Section 5.4.3)
LF-9C vs. LF-1E/PI-27E (Section 5.4.4)
LF-9C vs. LF-1E (Section 5.5)

By beginning with options within the same geographic cluster, the analysis focused on a more limited range of differences and tradeoffs. The much broader range of differences across geographic clusters were then addressed. An overall ranking of options is not possible from this procedure. Such a ranking is only possible if all 15 pairs of siting options are compared. The procedure is, however, consistent with OWMC's desire to identify a "preferred" siting option.

For the reasons cited above, siting options within geographic clusters are compared first, using a paired comparison approach, i.e. Milton (LF-4N/PI-1N versus LF-4N/PI-13N), West Lincoln (LF-3C versus LF-9C) and Niagara Falls (LF-1E versus LF-1E/PI-27E). A comparison of the preferred siting options from each geographic cluster is then undertaken. This analysis results in a narrowing of the siting options to a choice between one of the West Lincoln siting options (LF-9C) and one of the Niagara Falls siting options (LF-1E/PI-27E).

Within two of the geographic clusters (West Lincoln and Milton) there are clear preferences, i.e. LF-9C preferred over LF-3C and LF-4N/PI-1N preferred over LF-4N/PI-13N. There are also clear preferences in the comparisons between the preferred West Lincoln option (LF-9C) and the preferred Milton option (LF-4N/PI-1N) and between the preferred Niagara Falls option (LF-1E/PI-27E) and the preferred Milton option (LF-4N/PI-1N). However, the comparison between the two Niagara Falls options involves some difficult tradeoffs. There were also difficult tradeoffs in the comparison between the preferred Niagara Falls option (LF-1E/PI-27E) and the preferred West Lincoln option (LF-9C). A further cross-check was, therefore, subsequently undertaken to compare the second ranked Niagara Falls option (LF-1E) with the preferred West Lincoln option (LF-9C).

5.1.4 CHAPTER FORMAT

The differences and tradeoffs synthesis is organized as follows:

- paired comparisons within geographic clusters (Section 5.3);
- paired comparisons among geographic clusters (Section 5.4);
- cross-check - LF-9C versus LF-1E (Section 5.5);
- concluding comments (Section 5.6).

The analysis of each siting option pair is presented in the following manner:

- tradeoffs within risk pathways;
- tradeoffs among risk pathways;
- tradeoffs within study areas;
- tradeoffs among study areas;
- engineering differences and tradeoffs;
- risk/impact/engineering tradeoffs.

In addition to the material presented in this chapter, various supplementary materials are presented in Appendix C including:

- rationale for factor suitability levels;
- concerns raised by agencies and the public;
- rationale for major risks or impacts;
- major risk differences;
- major impact differences.

5.2 PAIRED COMPARISONS WITHIN GEOGRAPHIC CLUSTERS

5.2.1 INTRODUCTION

As previously noted, the comparative evaluation process involved a paired comparison of siting options, first within and then among geographic clusters. The comparisons within geographic clusters are as follows:

- Milton - LF-4N/PI-1N versus LF-4N/PI-13N (Section 5.2.2);
- West Lincoln - LF-3C versus LF-9C (Section 5.2.3);
- Niagara Falls - LF-1E versus LF-1E/PI-27E (Section 5.2.4).

This section documents these three paired comparisons.

5.2.2 LF-4N/PI-1N VERSUS LF-4N/PI-13N

5.2.2.1 Introduction

In this section, the two Milton siting options, LF-4N/PI-1N and LF-4N/PI-13N, are compared. Tables C.11 and C.12 in Appendix C identify the major potential risks and impacts associated with these two siting options. The tables also highlight the reasons for the identification of each major risk and impact.

In the subsections which follow, the risk, impact and cost tradeoffs are evaluated first within factor groupings, then among factor groupings and, finally, in terms of risk, impact and cost tradeoffs.

5.2.2.2 Tradeoffs Within Risk Pathways

Table 5.1 lists the major risk differences between LF-4N/PI-1N and LF-4N/PI-13N. Factors for which there are no or negligible differences are

TABLE 5.1

Summary of Major Risk Differences
LF-4N/PI-1N vs. LF-4N/PI-13N

RISK PATHWAY	DIFFERENCES FAVOURING LF-4N/PI-1N	DIFFERENCES FAVOURING LF-4N/PI-13N	NO OR NEGLIGIBLE DIFFERENCES [1]
• Transportation	-	-	• all transportation factors
• Air Quality	• risk from direct inhalation of emissions - chronic		• risk from direct inhalation - acute • risk from consumption of crops and livestock
• Hydrogeologic Suitability	• capability to provide natural containment		• ground water use
• Surface Water Suitability	• potential for surface water use interference		• susceptibility of site to flooding

[1] Differences screened from paired comparison

also listed. Table C.13 in Appendix C provides an elaboration of the magnitude and significance of these differences.

(a) Transportation

There are no major risk tradeoffs between LF-4N/PI-1N and LF-4N/PI-13N. There are very minor differences between the options for both risks on provincial and on local and regional access systems. These two siting options have the lowest spill and accident risks of all siting options.

(b) Air Quality

There are no air quality tradeoffs between LF-4N/PI-1N and LF-4N/PI-13N. The only difference between these options - risk from direct inhalation of emissions (chronic) - favours LF-4N/PI-1N.

(c) Hydrogeologic Suitability

Capability to provide natural containment favours LF-4N/PI-1N. LF-4N/PI-13N fails the basic acceptability screen of natural containment. There are no ground water use differences between the two options.

(d) Surface Water Suitability

There are no surface water risk tradeoffs. There is greater risk for downstream water users for siting option LF-4N/PI-13N. There are no flooding potential differences between LF-4N/PI-13N and LF-4N/PI-1N.

5.2.2.3 Tradeoffs Among Risk Pathways

There are no risk tradeoffs between the two siting options. The air quality, hydrogeologic suitability and surface water suitability factors all favour LF-4N/PI-1N.

5.2.2.4 Tradeoffs Within Study Areas

Table 5.2 lists the major impact differences between LF-4N/PI-1N and LF-4N/PI-13N. No or negligible differences are also listed. The magnitude

TABLE 5.2

Summary of Major Impact Differences
LF-4N/PI-1N vs. LF-4N/PI-13N

STUDY AREA	DIFFERENCES FAVOURING LF-4N/PI-1N	DIFFERENCES FAVOURING LF-4N/PI-13N	NO OR NEGLIGIBLE DIFFERENCES[1]
° Site	° displacement of farms with on-site headquarters	° displacement of historical, community and recreation features	° displacement of residents ° planned and proposed land use ° land use stability ° loss of farmland ° rare species ° natural vegetation displaced ° potential for occurrence of other significant natural features
° Site Vicinity	° disruption of day-to-day activities and/or the use and enjoyment of property (adjacent) ° property value impacts ° existing land use ° business activities negatively affected by the presence of OWMC facilities ° disruption of operations of community and recreation features (adjacent)	° provincial policies and plans ° partial displacement of farms ° restraints to dispersion	° disruption of day-to-day activities and/or the use and enjoyment of property (non-adjacent) ° proposed and planned land use ° disruption of operations of community and recreation features (site vicinity) ° disruption of non-adjacent vicinity farm operations

---

[1] Differences screened from paired

TABLE 5.2

Summary of Major Impact Differences

LF-4N/PI-1N vs. LF-4N/PI-13N

STUDY AREA	DIFFERENCES FAVOURING LF-4N/PI-1N	DIFFERENCES FAVOURING LF-4N/PI-13N	NO OR NEGLIGIBLE DIFFERENCES[1]
° Site Vicinity - continued	° disruption of adjacent farm operations ° other natural vegetation ° rare species		° SEUs ° fish and wildlife features of significance ° existing and anticipated air quality
° Community and Regional	° social cohesion ° disruption to farm economy ° community character	° provincial policies and plans ° stability of agricultural land base ° stability of farm population	° social stability ° regional and community economic base ° existing land use ° proposed and planned land use
° Access Roads	° disruption of farm traffic and cattle crossings	° disruption of day-to-day activities and/or the use and enjoyment of property (adjacent)	° disruption of day-to-day activities and/or the use and enjoyment of property (non-adjacent) ° disruption of operation of community and recreation features (adjacent) ° disruption of operation of community and recreation features (vicinity) ° existing land use ° proposed and planned land use ° fish communities

---

[1] Differences screened from paired comparison

and importance of these differences are highlighted in Table C.14 in Appendix C.

(a) Site

There is one on-site tradeoff. There is a greater displacement of farms with on-site headquarters for LF-4N/PI-13N. There is a greater displacement of historical, community and recreation features for LF-4N/PI-1N.

The difference is larger for the displacement of farms. Two more farms are displaced for LF-4N/PI-13N. The gross farm revenue difference is also significant (approximately $100,000). Only one more significant community and recreation feature is displaced for LF-4N/PI-1N (historic building) than for LF-4N/PI-13N. OWMC is committed to mitigate impacts caused by the displacement of historic buildings. Displacement of farms with on-site headquarters is more important (factor rank 6) than displacement of community and recreation features (factor rank 3). Although the displacement effects of both farms and community and recreation features can be mitigated, it may be more difficult to fully compensate for the impacts of farms displacement. Full compensation for the displacement of community and recreation features is possible. On the basis of the above, LF-4N/PI-1N is preferred for on-site impacts.

(b) Site Vicinity

LF-4N/PI-1N is also preferred for site vicinity impacts. Most differences favour LF-4N/PI-1N, with the exception of the following (see Table 5.2):

- provincial policies and plans;
- partial displacement of farms;
- restraints to dispersion.

Two of these factors are of low importance. Provincial policies and plan impacts are anticipated to be negligible and of low significance (factor rank 2). Similarly, restraints to dispersion are minimal for all sites (factor rank 2). To the extent that restraints to dispersion exist, they can be readily mitigated.

Partial displacement of farms is an important factor favouring LF-4N/PI-13N (factor rank 9). Impacts can be severe and long-term on those individuals involved, and they could impact sensitive operations. Mitigation of impacts is possible, but may not be complete. LF-4N/PI-1N is preferred for disruption of adjacent farm operations. This factor is more important than partial displacement because impacts may be more long-term and may not be mitigable. The magnitude of difference between the two options, based on these factors, is similar, but slightly favours LF-4N/PI-1N. Based on the above, LF-4N/PI-1N is slightly preferred for agriculture.

The minor preference for LF-4N/PI-13N, based on the two low ranked factors, is not sufficient to outweigh the factors favouring LF-4N/PI-1N.

(c) Community and Regional

LF-4N/PI-1N is also preferred for community and regional impacts. Three factors favour LF-4N/PI-13N and three factors favour LF-4N/PI-1N. However, the differences favouring LF-4N/PI-13N are of less importance and magnitude for the following reasons.

There is greater conflict with provincial policies and plans for LF-4N/PI-1N than with the other siting options. This factor is of lowest importance (factor rank 1) because of the negligible impacts anticipated.

Two highly ranked agricultural factors also result in a marginal preference for LF-4N/PI-13N. Potential effects on stability of farm population and on the stability of the agricultural land base are marginally less for LF-4N/PI-13N. However, this preference is counter-balanced by a greater disruption of the farm economy difference which favours LF-4N/PI-1N. Farm economy impacts are important because there is the potential for serious, unanticipated and long-term impacts. In addition, mitigation potential is more limited because such impacts tend to extend over a broader area and are clearly linked to perceptions and attitudes. This disruption of farm economy difference favouring LF-4N/PI-1N, more than offsets significance than the two agricultural factors indicating a minor preference for LF-4N/PI-13N.

The remaining two factors favouring LF-4N/PI-1N are social cohesion and community character. Social cohesion is of moderate importance (factor rank 6). The magnitude of the difference is, however, considerable. LF-4N/PI-13N is potentially most impacted of all siting options for resident displacement and third most impacted for potential out-migration. LF-4N/PI-1N experiences relatively low impacts for these indicators. The community character (factor rank 8) differences between the options are minor. Visual and heritage features impacts are slightly less for LF-4N/PI-1N.

Overall, LF-4N/PI-1N is favoured. LF-4N/PI-13N is expected to experience greater agricultural and social impacts. The only difference favouring LF-4N/PI-13N is conflicts with provincial policies and plans. Impacts are anticipated to be minimal in this case, as reflected in the lower factor ranking. As a result, the overall community and regional preference is for LF-4N/PI-1N.

(d) Access Roads

Two access road impact differences occur with the Milton siting options (see Table 5.2). There is a minor preference for LF-4N/PI-13N for the disruption of day-to-day activities and/or the use and enjoyment of property (adjacent) factor. LF-4N/PI-1N is strongly preferred for disruption of farm traffic and cattle crossings. Both of these factors are ranked as high importance (factor rank 8). Overall, LF-4N/PI-1N is preferred because of the greater agricultural impact difference.

5.2.2.5 Tradeoffs Among Study Areas

There are no impact factor grouping tradeoffs. The overall preference for every study area is LF-4N/PI-1N.

5.2.2.6 Engineering Tradeoffs

The engineering factors favour LF-4N/PI-1N (see Table 5.3). Capital and operating costs are less for LF-4N/PI-1N. LF-4N/PI-1N provides an opportunity for the provision of rail service. Such an opportunity does not exist at LF-4N/PI-13N. The only minor disadvantage for LF-4N/PI-1N is that alternative placement of the stack is not possible.

5.2.2.7 Tradeoffs - Risk/Impact/Engineering

There are no risk or impact tradeoffs. Both risks and impacts favour LF-4N/PI-1N. This conclusion is supported by the engineering factors.

5.2.3 LF-9C VERSUS LF-3C

5.2.3.1 Introduction

In this section, the two West Lincoln siting options, LF-3C and LF-9C, are compared. Tables C.15 and C.16 in Appendix D identify the major potential risks and impacts associated with the two siting options. The tables also highlight the reasons for the identification of each major risk and impact.

5.2.3.2 Tradeoffs Within Risk Pathways

Table 5.4 lists the major risk differences between LF-3C and LF-9C. No or negligible differences are also listed. Table C.17 in Appendix C provides an elaboration of the magnitude and importance of these differences.

TABLE 5.3

Engineering Differences

LF-4N/PI-1N vs. LF-4N/PI-13N

Factor/Indicators	LF-4N/PI-1N	LF-4N/PI-13N
° Capital Costs	$190,382,000	$191,512,000
° Operating Costs	$ 42,295,000	$ 42,536,000
° Engineering Flexibility		
- rail access for additive reagents	- possible	- not feasible
- landfill design type	- conventional (site adapted) - above ground (base case)	- conventional (site adapted) - above ground (base case)
- facility layout	- modular or rectangular	- modular or rectangular
- alternative placement of stack location	- no	- yes
- landfill life (years)	- total 15.5 - partial 24.5	- total 15.5 - partial 24.5

TABLE 5.4

Summary of Major Risk Differences

LF-9C vs. LF-3C

RISK PATHWAY	DIFFERENCES FAVOURING LF-9C	DIFFERENCES FAVOURING LF-3C	NO OR NEGLIGIBLE DIFFERENCES[1]
• Transportation	• transportation risks on local and regional access roads due to accident involvement of OWMC generated traffic • transportation risks on local and regional roads due to hazard-based spills of OWMC generated traffic		• annual province-wide hazard-based spill index of OWMC generated transport • annual province-wide accident involvements of OWMC generated transport
• Air Quality	• risks from ingestion of cistern and pond water	• risks from direct inhalation of emissions - acute • risks from direct inhalation of emissions - chronic	• risks from consumption of crops and livestock
• Hydrogeologic Suitability		• ground water use	• capability of providing natural containment
• Surface Water Suitability	• susceptibility of site to flooding		• potential for water use interference

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[1] Differences screened from paired comparison

(a) Transportation

There are no transportation risk tradeoffs. LF-9C is preferred for spills and accidents on local and regional roads. LF-9C and LF-3C share the same province-wide access system.

The local and regional access route to LF-3C is longer than the route to LF-9C, resulting in potentially higher spill and accident rates.

(b) Air Quality

With respect to air quality risk, LF-9C is favoured for risk from the ingestion of cistern and pond water. LF-3C is preferred for direct inhalation of emissions, both chronic and acute. LF-3C is preferred overall for the following reasons:

- risks from direct inhalation of emissions are more highly ranked factors than indirect pathway factors;
- the generic risk assessment indicates that direct exposure pathways produce more severe effects than indirect exposure pathways (Environ, 1985);
- the potential for mitigation is limited for the direct pathways. Measures can be taken to monitor contaminant levels associated with crops and livestock. Remedial action can then be taken prior to long-term risk to human health.

(c) Hydrogeologic Suitability

There are no hydrogeologic suitability tradeoffs. LF-3C is clearly preferred for ground water use. Potential expansion of the use of the aquifer is limited with LF-3C. There is greater potential expansion of the use of the aquifer under LF-9C.

(d) Surface Water Suitability

There are no surface water pathway tradeoffs. LF-9C is strongly preferred for flooding potential. LF-3C has a major flooding constraint due to a flood-prone area along Beaver Creek. There are no surface water use interference differences.

5.2.3.3 Tradeoffs Among Risk Pathways

There are several risk pathway tradeoffs between siting options LF-3C and LF-9C. There is a moderate preference for LF-9C for the highly ranked local and regional access route factors and a strong preference for LF-9C for the lowly ranked susceptibility to flooding factor. The high ranked direct air inhalation factors marginally favour LF-3C. The moderately ranked ground water use factor strongly favours LF-3C (see Table 5.4).

LF-9C is preferred for the highly ranked transportation risk factors. LF-3C is preferred for air risks. In both cases, the difference between the options is minor. The two options are very highly rated from an overall air risk perspective. Thus, the minor differences between the options are of limited importance. However, the two options are the least favoured from a transportation risk perspective. Thus, the choice of LF-9C represents a clear opportunity for risk reduction, i.e. by reducing the distance travelled on local and regional access roads.

On the basis of the above, the transportation risks for LF-3C represent a greater constraint than the air quality risks for LF-9C.

LF-3C is strongly preferred for the moderately ranked ground water use factor. LF-9C is strongly preferred for the low ranked susceptibility to flooding factor.

The constraint with ground water use at LF-9C is somewhat diminished by the site's good natural containment, i.e. estimated contaminant breakthrough times to the underlying aquifer are 1200 to 1700 years. LF-3C however, is the least favoured site for flood susceptibility. Thus, by selecting LF-9C over LF-3C, there is a further opportunity for reducing risk by avoiding a potential flooding constraint. Minimizing risk by minimizing ground water use at LF-9C is less of a concern because of the good natural containment possessed by both options. The selection of LF-9C over LF-3C is also more consistent with the site selection principle of ensuring a second level of natural protection through siting decisions, rather than relying on active engineering to avoid flooding risks.

Overall, LF-9C is marginally preferred for risk. The transportation risk preference for LF-9C is considered more important than the ground water use risk preference for LF-3C. The potential risks on local and regional roads are severe and with a greater likelihood of occurrence with LF-3C. The ground water use risks are remote and potentially mitigable. In addition, the high capability to provide natural containment for both West Lincoln options reduces the likelihood of ground water contamination.

5.2.3.4 Tradeoffs Within Study Areas

Table 5.5 lists the major impact differences between LF-3C and LF-9C. No or negligible differences are also listed. Table C.18 in Appendix C provides an elaboration of the magnitude and importance of these differences.

(a) Site

LF-9C is preferred over LF-3C for on-site impacts. All differences, except for rare species, clearly favour LF-9C (see Table 5.5). These differences include:

- displacement of residents;
- land use stability;
- displacement of farms with on-site headquarters;
- loss of farmland;
- natural vegetation displaced;
- potential for occurrence of other significant natural features.

TABLE 5.5

Summary of Major Impact Differences

LF-9C vs. LF-3C

STUDY AREA	DIFFERENCES FAVOURING LF-9C	DIFFERENCES FAVOURING LF-3C	NO OR NEGLIGIBLE DIFFERENCES[1]
° Site	° displacement of residents ° land use stability ° displacement of farms with on-site headquarters ° loss of farmland ° natural vegetation displaced ° potential for occurrence of other significant features	° rare species	° planned and proposed land use
° Site Vicinity	° disruption of day-to-day activities and/or the use and enjoyment of property (adjacent) ° business activities negatively affected by the presence of OWMC facilities ° disruption of operations of community and recreation features (vicinity) ° partial displacement of farms ° fish and wildlife features of significance	° disruption of day-to-day activities and or the use and enjoyment of property (non-adjacent) ° disruption of adjacent farm operations ° disruption of non-adjacent vicinity farm operations	° planned and proposed land use ° land use stability ° property value impacts ° disruption of operations of community and recreation features (adjacent) ° existing and anticipated air quality

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[1] Differences screened from paired comparison

TABLE 5.5

Summary of Major Impact Differences

LF-9C vs. LF-3C

STUDY AREA	DIFFERENCES FAVOURING LF-9C	DIFFERENCES FAVOURING LF-3C	NO OR NEGLIGIBLE DIFFERENCES[1]
° Site Vicinity - Continued	° other natural vegetation ° existing land use		
° Community and Regional	° social cohesion ° social stability ° regional and community economic base	° community character ° stability of agricultural land base ° disruption to farm economy	° municipal finance ° existing land use ° proposed and planned land use ° stability of farm population
° Access Roads	° disruption of day-to-day activities and/or the use and enjoyment of property (adjacent) ° disruption of operations of community and recreation features (adjacent) ° disruption of operations of community and recreation features (vicinity) ° disruption to farm traffic and cattle crossings ° disruption to crop and livestock production		° disruption of day-to-day activities and/or the use and enjoyment of property (vicinity) ° existing land use ° planned and proposed land use ° fish communities

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[1] Differences screened from paired comparison

Greater impacts on rare plant and animal species are predicted for LF-9C (i.e. highest impact of all siting options, together with LF-1E/PI-27E). Relatively low impacts are predicted for LF-3C.

Impacts on rare species are important (factor rank 8) because impacts are permanent and interconnected to other natural environment impacts. However, the species loss does not refer to endangered species (GLAL, 1985a). Therefore, impacts on rare species is not sufficiently important, based on factor rankings and the importance of the loss, to outweigh the six factors favouring LF-3C.

(b) Site Vicinity

There are difficult social and agricultural impact tradeoffs for the social and agricultural factors. The overall social preference for the most highly ranked "disruption of adjacent residents" factor is for LF-9C. The preference for the slightly lower ranked "disruption of non-adjacent residents" factor is for LF-3C. The higher ranking for adjacent residents reflects the potential for direct, adverse and long-term impacts that are of concern to the public. This higher ranking indicates that LF-9C should be preferred. However, the magnitude of impacts on non-adjacent residents is greater with LF-9C. When the high impacts for LF-9C for non-adjacent impacts are combined with the lower impacts for adjacent residents, the overall impacts favour LF-3C. Disruption of operations of community and recreation features (vicinity), however, favours LF-9C. LF-3C has the greatest impact and LF-9C has the least impact for this low ranked factor. This difference, when combined with impacts on residents, results in minor differences between LF-3C and LF-9C for social factors in the site vicinity, although LF-9C is slightly preferred.

Partial displacement of farms is considerably greater for LF-3C than for LF-9C. Disruption of adjacent farm operations and non-adjacent vicinity operations is marginally higher for LF-9C than for LF-3C. All these factors are highly ranked (9 or 10). The large difference in partial displacement of farms favouring LF-9C more than offsets the minor disruption of farm operation differences favouring LF-3C. As a result, LF-9C is favoured over LF-3C.

. All remaining differences favour LF-9C. These include:

- business activities negatively affected by the presence of OWMC facilities;
- fish and wildlife features of significance;
- other natural vegetation;
- existing land use.

LF-9C is preferred overall for site vicinity impacts. The biology, economic, agriculture and land use differences between options favour LF-9C. There is also a minor social minor preference for LF-9C.

(c) Community and Regional

There is no clear community and regional preference. The limited differences between the two options reflect the fact that the community under consideration is essentially the same for the two West Lincoln options.

There are slight preference differences for several factors. These differences are shown in Table 5.6. There is a social stability and regional and community economic base preference for LF-9C. Both of these factors are ranked at a level 8. Social cohesion impacts are considerably less for LF-9C than for LF-3C. However, this factor is ranked only at level 6. Three factors, ranked at level 8, slightly favour LF-3C. Community character, stability of agricultural land base and disruption of farm economy all marginally favour LF-3C.

Overall, there is no clear preference between the two options. The social stability and social cohesion preference is for LF-9C. This option will be less impacted by resident displacement and resident out-migration

TABLE 5.6

Tradeoffs Within Community and Regional Study Area

LF-3C and LF-9C

DIFFERENCES FAVOURING LF-9C	FACTOR SUITABILITY LEVEL DIFFERENCE	DIFFERENCES FAVOURING LF-3C	FACTOR SUITABILITY LEVEL DIFFERENCE
o social stability o factor is ranked eight because potential for serious unanticipated impacts that could be long-term and impacts widely connected to other factors and have limited potential for mitigation o magnitude of difference is low	-0.3	o community character o factor is ranked eight for same reasons as for social stability o magnitude of difference is extremely low	-0.1
o regional and community economic base o factor is ranked eight because moderate severity of both positive and negative impacts expected but potential for severe unanticipated risk and high level of interconnection with other factors	+0.4	o stability of agricultural land base and disruption to farm economy o both of these factors are ranked eight for the same reasons as social stability o magnitude of difference is low	-0.6 -0.4
o social cohesion o factor is ranked as six because although considered as important as community character and social stability, the data available only partially assesses social cohesion o magnitude of difference is greater than for any other difference between LF-9C and LF-3C for community and region but factor rank is lower	-4.0		

and is a less stable and cohesive community than that surrounding LF-3C. In addition, the beneficial community and regional economic base effects are slightly greater with LF-3C.

In contrast, LF-3C is slightly preferred for community character. LF-3C has a slightly less stable agricultural land base and slightly less disruption to the farm economy (gross farm revenue and livestock index exposure to fugitive emissions). The differences favouring each option are equally important and similar in impact.

(d) Access Roads

There are no access road tradeoffs. All differences favour LF-9C.The shorter access route to LF-9C results in less potential impacts on residents, community and recreation features and agricultural uses.

5.2.3.5 Tradeoffs Among Study Areas

There are tradeoffs among study areas. LF-9C is favoured for site, site vicinity and access route study areas. There is no community and regional preference. As a result, LF-9C is clearly preferred.

5.2.3.6 Engineering Tradeoffs

The costs of LF-9C and LF-3C are considered equal. LF-9C has higher capital costs, but lower operating costs than LF-3C. The only other difference between the options is that a modular layout is not possible for LF-9C because of the small size and rectangular shape of the site. This difference is not of great importance because the rectangular layout is adequate for development of the facility. Table 5.7 lists the engineering differences between the options.

5.2.3.7 Tradeoffs - Risk/Impact/Engineering

There are no risk and impact tradeoffs. Both the risk and impact factor groupings favour LF-9C.

TABLE 5.7

Engineering Differences

LF-9C vs. LF-3C

Factor/Indicators	LF-9C	LF-3C
° Capital Costs	$192,085,000	$189,533,000
° Operating Costs (yr. 10-20)	$ 42,500,000	$ 42,828,000
° Engineering Flexibility		
- rail access for additive reagents	- yes	- yes
- landfill design type	- conventional (site adapted) - above ground (base case) - shallow entombed	- conventional (site adapted) - above ground (base case) - shallow entombed
- facility layout	- rectangular	- modular or rectangular
- alternative placement of stack location	- yes	- yes
- landfill life (years)	- total 14 - partial 23.5	- total 19 - partial 32.5

There is no strong engineering preference for either LF-9C or LF-3C.

5.2.4 LF-1E VERSUS LF-1E/PI-27E

5.2.4.1 Introduction

In this section, the two Niagara Falls siting options, LF-1E and LF-1E/PI-27E are compared. Tables C.19 and C.20 in Appendix C identify the potential risks and impacts associates with the two siting options. The tables also highlight the reasons for the identification of each major risk and impact.

5.2.4.2 Tradeoffs Within Risk Pathways

Table 5.8 lists the major risk differences between LF-1E and LF-1E/PI-27E. Factors for which there were no or negligible differences are also listed. Table C.21 in Appendix C provides an elaboration of the magnitude and importance of these differences.

(a) Transportation

There are negligible transportation risk differences between LF-1E and LF-1E/PI-27E. Only the frequency of various types of vehicle movements varies between the two options. This difference does not affect risk levels.

(b) Air Quality

The major air tradeoff between LF-1E and LF-1E/PI-27E is between direct and indirect inhalation. Both direct acute and chronic inhalation factors favour LF-1E. Risk from ingestion of cisterns and pond water favours LF-1E/PI-27E. The difference between the options is large for both chronic emissions and cisterns and ponds. Acute emission differences are less pronounced.

TABLE 5.8

Summary of Major Risk Differences

LF-1E vs. LF-1E/PI-27E

RISK PATHWAY	DIFFERENCES FAVOURING LF-1E	DIFFERENCES FAVOURING LF-1E/PI-27E	NO OR NEGLIGIBLE DIFFERENCES[1]
• Transportation			• all transportation factors
• Air Quality	• risks from direct inhalation of emissions - chronic • risks from direct inhalation of emissions - acute	• risks from ingestion of cistern and pond water	• risks from consumption of crops and livestock
• Hydrogeologic Suitability			• capability of providing natural containment • ground water use
• Surface Water Suitability			• potential for surface water use interference

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[1] Differences screened from paired comparison

LF-1E is preferred overall. Direct inhalation is more important than risk from indirect emissions. Direct inhalation effects are potentially severe. Mitigation potential is limited. The fugitive emissions risk is 1×10^{-6} - the minimal acceptable level. The severity of risk is less for indirect risk pathways. In addition, contaminant levels can be monitored and remedial actions taken prior to long-term risk to human health.

(c) Hydrogeologic Suitability

No hydrogeologic suitability tradeoffs were identified between the options. Both options have a locally variable confining layer and the aquifer is capable of meeting more stringent water use requirements.

(d) Surface Water Suitability

There are no major surface water tradeoffs between the two options. Both options have relatively low flooding constraints, no potable use immediately downstream from the site, and low downstream water use indices.

5.2.4.3 Tradeoffs Among Risk Pathways

Air quality is the only risk pathway where one option is preferred. LF-1E is preferred because direct inhalation risks are lower for this option.

5.2.4.4 Tradeoffs Within Study Areas

Table 5.9 lists the major impact differences between LF-1E and LF-1E/PI-27E. The table also lists factors for which there are no or negligible differences. Table C.22 in Appendix C elaborates on the magnitude and significance of these differences.

(a) Site and Site Vicinity

LF-1E is preferred for the displacement of existing residents and businesses. LF-1E/PI-27E is preferred for future uses. The same tradeoff between existing and future uses occurs in the site vicinity. The arguments on both sites of this tradeoff are similar for both study areas. The

TABLE 5.9

Summary of Major Impact Differences

LF-1E vs. LF-1E/PI-27E

STUDY AREA	DIFFERENCES FAVOURING LF-1E	DIFFERENCES FAVOURING LF-1E/PI-27E	NO OR NEGLIGIBLE DIFFERENCES[1]
• Site	• displacement of residents • displacement of businesses • rare species	• proposed and planned land use • land use stability • displacement of farms with on-site headquarters • natural vegetation displaced • loss of farmland	• existing land use • potential for occurrences of other significant features
• Site Vicinity	• disruption of day-to-day activities and/or the use and enjoyment of property (adjacent) • disruption of day-to-day activities and/or the use and enjoyment of property (non-adjacent) • business activities negatively affected by the presence of OWMC facilities • disruption of operations of community and recreation features (adjacent to site) • disruption of operations of community and recreation features (site vicinity) • disruption of adjacent farm operations	• business activities positively affected by the presence of OWMC facilities • proposed and planned land use • partial displacement of farms • disruption of non-adjacent vicinity operations	• existing land use • land use stability • property value changes

[1] Differences screened from paired comparison

TABLE 5.9

Summary of Major Impact Differences

LF-1E vs. LF-1E/PI-27E

STUDY AREA	DIFFERENCES FAVOURING LF-1E	DIFFERENCES FAVOURING LF-1E/PI-27E	NO OR NEGLIGIBLE DIFFERENCES[1]
° Site Vicinity - Continued	° significant environmental units (SEUs) ° fish and wildlife features of significance ° other natural vegetation ° rare species ° existing and anticipated air quality		
° Community and Regional	° tourism operations ° social stability ° existing land use	° community character ° community and regional economic base ° stability of agricultural land base ° disruption to the farm economy	° social cohesion ° tourism economy ° stability of farm population

[1] Differences screened from paired comparison

analyses for these two study areas have, therefore, been combined. The major arguments in this tradeoff are highlighted in Table 5.10.

LF-1E/PI-27E is favoured for the following reasons. PI-27E offers a greater level of land use compatibility, both now and in the future. The OWMC facility is consistent with municipal official plan designations and compatible with nearby heavy industrial land uses (LKA, 1985). There are additional impacts with LF-1E/PI-27E on residents, community and recreation features, and air quality. They do not, however, outweigh the benefits of land use compatibility. The site vicinities for the two options are very similar. Since LF-1E and PI-27E are very close to one another, impacts are very similar. Many of the impacts of an OWMC facility at PI-27E would occur in any event with industrial development. Industrial development in the area could also be hastened by the servicing of LF-1E.

Although negative impacts on businesses are greater for LF-1E/PI-27E, it is ranked very close to LF-1E because of the large number of positively affected businesses within the site vicinity of PI-27E.

The agricultural analysis supports the preference for LF-1E/PI-27E (Ecologistics, 1985, p.163). The agricultural consultant has assumed that farming operations on industrially designated land represents an interim land use.

(b) Community and Regional

The community and regional differences between the options do not clearly favour either option. The community and regional areas are essentially the same because of the close proximity of the options.

Community character impacts are slightly greater for LF-1E/PI-27E.

Less impacts on tourism are anticipated for LF-1E. LF-1E/PI-27E may have substantial impacts on tourism. Overall, greater positive impacts on the community and regional economic base are expected for LF-1E/PI-27E. Economic effects on the farm economy are also expected to be less for LF-1E/PI-27E.

TABLE 5.10

Summary of Site/Site Vicinity Differences

LF-1E Versus LF-1E/PI-27E

LF-1E PREFERRED	LF-1E/PI-27E PREFERRED
Site	
o less displacement of residents	o PI-27E is industrially designated; LF-1E is designated for agricultural use
o displacement of residents and businesses are direct, short-term and severe impacts	o an incinerator and a physical/chemical treatment plant are more consistent with an industrial designation
o displacement effects are widely connected to other factors	o a landfill is more consistent with a rural designation than is an incinerator or a physical/chemical treatment plant
o timing of development at PI-27E uncertain; large supply of industrial land in Niagara Falls; site not serviced and municipality has no clear policy on sequence of development	o with an industrial designation there are already changes, e.g. land value and land ownership changes, which may preclude continued agricultural uses on-site beyond the short-term
o greater displacement of businesses at PI-27E	o with an industrial designation residential, commercial and community facility uses, as well as natural features, can likely be retained on-site until industrial development is imminent; nevertheless, at some point such uses and features will likely be displaced
	o the placement of an incinerator and a physical/chemical treatment plant on an industrially designated site appear consistent with local and regional planning policies - policies subject to review by provincial agencies and the public

TABLE 5.10

Summary of Site/Site Vicinity Differences
LF-1E Versus LF-1E/PI-27E

LF-1E PREFERRED

Site Vicinity

- o less disruption of residents and community and recreation features
- o resident, business, community feature disruption effects are direct, potentially severe and long-term
- o disruption effects may not be mitigable
- o negative business impacts approximately half those associated with LF-1E/PI-27E
- o much less potential off-site impacts on natural features
- o relatively large differences in potential air quality impacts favouring LF-1E

LF-1E/PI-27E PREFERRED

- o with an industrial designation - greater compatibility with surrounding land uses - both existing and future; expectation of industrial-type development by residents and uses in vicinity of such designations
- o compatible industrial uses and designations in close proximity to PI-27E; not the case with LF-1E to the same extent
- o much greater positive business impacts; with negative impacts - mitigation and compensation potential
- o provision of industrial-type use and servicing of site could contribute to further industrial-type development in vicinity of site; such a pattern is compatible with designations and existing uses in the vicinity of PI-27E; not the case with LF-1E to the same extent

LF-1E has a slightly greater proportion of compatible industrial lands in the community and region. However, agricultural land is less stable for LF-1E/PI-27E. Therefore, the agricultural preference is for LF-1E/PI-27E.

Overall, there is no clear preference in the community and regional study area.

(c) Access Roads

There are no differences or tradeoffs in the access roads study area.

5.2.4.5 Tradeoffs Among Study Areas

Overall, LF-1E/PI-27E is the preferred option. This conclusion is based on the favourable on-site and site vicinity land use designations and its compatibility with nearby existing industrial land uses.

5.2.4.6 Engineering Tradeoffs

Table 5.11 lists the engineering differences between the options. LF-1E has lower capital and operating costs than LF-1E/PI-27E. These differences represent a small difference in total cost estimates.

There are potential hydrogeologic constraints at LF-1E which could locally restrict landfill development. The addition of PI-27E allows for the entire LF-1E area to be developed for landfill. As a result, there is greater potential for avoiding hydrogeologically constrained areas on LF-1E. The LF-1E/PI-27E option also leaves open the option of landfill development at both sites.

5.2.4.7 Tradeoffs - Risk/Impact/Engineering

There are several major tradeoffs between LF-1E and LF-1E/PI-27E. Minor air quality differences result in a risk preference favouring LF-1E. The overall impact preference is for LF-1E/PI-27E.

TABLE 5.11

Engineering Differences

LF-1E vs. LF-1E/PI-27E

Factor/Indicators	LF-1E	LF-1E/PI-27E
° Capital Costs	$192,066,000	$194,002,000
° Operating Costs (annual)	$ 45,354,000	$ 46,398,000
° Engineering Flexibility		
- rail access for additive reagents	- yes	- yes
- landfill design type	- conventional - above ground	- conventional - above ground
- facility layout	- modular or rectangular	- modular
- operating area expansion potential (within acquisition area)	- no	- no
- alternative placement of stack location	- yes	- yes
° Site Area		
- site size	- acceptable	- acceptable
- landfill life (years)	- total 12 - partial 21	- total 11 - partial 19.5

Overall, LF-1E/PI-27E is preferred. The clear impact differences favouring LF-1E/PI-27E more than offset the minor risk differences favouring LF-1E. The overall differences between the two options are limited.

5.3 PAIRED COMPARISONS AMONG GEOGRAPHIC CLUSTERS

5.3.1 INTRODUCTION

As detailed in Section 5.3, the results of the paired comparisons within geographic clusters are as follows:

- Milton - LF-4N/PI-1N preferred over LF-4N/PI-13N;
- West Lincoln - LF-9C preferred over LF-3C;
- Niagara Falls - LF-1E/PI-27E preferred over LF-1E.

This section documents the comparison of the preferred options which emerged from the geographic clusters comparisons. The options compared are as follows:

- LF-4N/PI-1N vs. LF-9C;
- LF-4N/PI-1N vs. LF-1E/PI-27E;
- LF-9C vs. LF-1E/PI-27E.

5.3.2 LF-4N/PI-1N VERSUS LF-9C

5.3.2.1 Introduction

In this section, the preferred Milton siting option (LF-4N/PI-1N) is compared to the preferred West Lincoln siting option (LF-9C).
Tables C.11 and C.16 in Appendix C identify the major potential risks and impacts associated with these two siting options. The tables highlight the reasons for the identification of each major risk and impact.

TABLE 5.12

Summary of Major Risk Differences

LF-9C vs. LF-4N/PI-1N

RISK PATHWAY	DIFFERENCES FAVOURING LF-9C	DIFFERENCES FAVOURING LF-4N/PI-1N	NO OR NEGLIGIBLE DIFFERENCES[1]
° Transportation		° annual province-wide hazard based spill index of OWMC generated transport ° annual province-wide accident involvements of OWMC generated transport ° transportation risks on local and regional access roads due to accident involvements of OWMC generated transport ° transportation risks on local and regional access roads due to hazard-based spills of OWMC generated transport	
° Air Quality	° risk from direct inhalation of emissions - chronic ° risk from direct inhalation of emissions - acute	° risk from consumption of crops and livestock	° risk from ingestion of cistern and pond water
° Hydrogeologic Suitability	° capability of providing natural containment		
° Surface Water Suitability			° susceptibility of site to flooding

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[1] Differences screened from paired comparison

5.3.2.2 Tradeoffs Within Risk Pathways

Table 5.12 lists the major risk differences between LF-4N/PI-1N and LF-9C. No or negligible differences are also listed. Table C.23 in Appendix C provides an elaboration of the magnitude and importance of these differences.

(a) Transportation

There are no transportation risk tradeoffs. LF-4N/PI-1N is clearly favoured over LF-9C for all transportation risk factors. This preference is largely the result of the proximity of the Milton siting options to the major sources of special waste, the QEW and Highway 401. LF-4N/PI-1N is the second least constrained siting option (after LF-4N/PI-13N) for overall transportation risk.

(b) Air Quality

LF-9C is preferred for air quality risk for the direct acute and chronic inhalation of emissions. LF-4N/PI-1N is preferred for consumption of crops and livestock risk. LF-9C is preferred for overall air quality risk because:

- direct inhalation of emission factors are ranked more highly than indirect pathway factors;

- the generic risk assessment indicates that direct exposure pathways produce more severe effects than any of the indirect exposure pathways (Environ, 1985);

- mitigation potential is more limited for the direct pathways. Measures can be taken to monitor contaminant levels associated with crops and livestock exposure to remedial action prior to long-term risk to human health;

- LF-4N/PI-1N has higher values for existing and future population exposure.

(c) Hydrogeologic Suitability

There are no hydrogeologic suitability tradeoffs. LF-9C is strongly favoured for capability to provide natural containment. The confining layer at LF-9C is uniform and laterally and vertically continuous. Contaminant breakthrough times to the underlying aquifer at LF-9C are long. The confining layer at LF-4N/PI-1N is also uniform and laterally and vertically continuous at both sites. The confining layer at both sites is, however, thin. As a result, breakthrough times are short.

(d) Surface Water Suitability

There are no surface water tradeoffs between the siting options. There are negligible differences between the siting options for susceptibility of site to flooding.

5.3.2.3 Tradeoffs Among Risk Pathways

LF-9C is favoured for air quality and hydrogeologic suitability. LF-4N/PI-1N is favoured for all transportation factors. There are negligible surface water suitability differences between the siting options.

LF-4N/PI-1N is clearly favoured for transportation risks. This preference pertains to overall transportation risks and to the local and regional components of the access system. The number of potential spills and accident involvements do not vary greatly among the siting options. This limited difference among options largely stems from decisions made earlier in the site selection process. As an example, the estimates range of predicted spills of special waste considered hazardous to human health is from one spill every 6.0 years for LF-9C to one spill every 7.2 years for LF-4N/PI-1N. In contrast, there is a much greater difference in hydrogeologic suitability. LF-4N/PI-1N is marginal because of short breakthrough times. The clear air quality preference for LF-9C reinforces the overall risk preference for LF-9C.

In conclusion, the transportation risk differences favouring LF-4N/PI-1N are not sufficient to offset the major hydrogeologic and, to a lesser extent, air quality risks favouring LF-9C.

5.3.2.4 Tradeoffs Within Study Areas

Table 5.13 lists the major impact differences between LF-9C and LF-4N/PI-1N. No or negligible differences are also listed. Table C.24 in Appendix C provides an elaboration of the magnitude and importance of these differences.

(a) Site

LF-9C is preferred to LF-4N/PI-1N for on-site impacts. LF-9C has less displacement of residents, historical, community and recreation features and farmland. Fewer rare species are displaced with LF-4N/PI-1N.

The displacement of residents and loss of farmland differences are substantial. LF-9C has the least displacement of residents of all siting options. LF-4N/PI-1N has the third highest number of residents. LF-9C is the second least impacted siting option for farmland loss. LF-4N/PI-1N is the most impacted siting option for farmland loss. Approximately 264 ha of Class 1 equivalent lands are lost with LF-4N/PI-1N. LF-9C involves the displacement of only 90 ha of Class 1 equivalent lands.

No historical, community and recreation features are displaced with LF-9C. Two significant features are displaced with LF-4N/PI-1N. However, the severity of potential effects is minimal and OWMC is committed to mitigation. The displacement of historical, community and recreation features is, also a low ranked factor. Consequently, the community and recreation feature differences between the two siting options are of limited importance.

There is a greater potential impact on rare plant and animal species with LF-9C (GLAL, 1985a, p.92). Rare species are a highly ranked factor.

TABLE 5.13

Summary of Major Impact Differences
LF-9C vs. LF-4N/PI-1N

STUDY AREA	DIFFERENCES FAVOURING LF-9C	DIFFERENCES FAVOURING LF-4N/PI-1N	NO OR NEGLIGIBLE DIFFERENCES[1]
° Site	° displacement residents ° displacement of historical community and recreation features ° loss of farmland	° rare species	° planned and proposed land use ° land use stability ° natural vegetation displaced ° potential for occurrence of other significant features
° Site Vicinity	° property value impacts ° disruption of day-to-day activities and/or the use and enjoyment of property (adjacent to site) ° disruption of day-to-day activities and/or the use and enjoyment of property (non-adjacent) ° disruption of operations of community and recreation features (adjacent to site) ° disruption of operations of community and recreation features (site vicinity) ° existing land use	° land use stability ° disruption of adjacent farm operations ° disruption of non-adjacent farm operations ° fish and wildlife features of significance	° planned and proposed land use ° existing and anticipated air quality ° significant environmental units (SEUs) ° other natural vegetation

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[1] Differences screened from paired comparison

TABLE 5.13

Summary of Major Impact Differences

LF-9C vs. LF-4N/PI-1N

STUDY AREA	DIFFERENCES FAVOURING LF-9C	DIFFERENCES FAVOURING LF-4N/PI-1N	NO OR NEGLIGIBLE DIFFERENCES[1]
• Site Vicinity - Continued	• provincial plans and policies • partial displacement of farms • rare species • restraints to dispersion		
• Community and Regional	• community character • municipal finance • existing land use • planned and proposed land use • provincial policies and plans	• social stability • stability of farm population • disruption to farm economy • stability of agricultural land base • community and regional economic base	
• Access Roads	• disruption of operations of community and recreation features (vicinity) • disruption to farm traffic and cattle crossings • fish communities	• disruption of day-to-day activities and/or the use and enjoyment of property (adjacent) • disruption of day-to-day activities and/or the use and enjoyment of property (vicinity) • existing land use	• disruption of operations of community and recreation features (adjacent) • planned and proposed land use

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[1] Differences screened from paired comparison

Any impact may represent a permanent resource loss. However, the resource loss is of limited absolute significance. The dependence of the rare animal species on LF-9C remains to be determined (GLAL, 1985a, p.97). Certain impacts on rare species are also potentially mitigable.

In conclusion, major displacement of residents and farmland differences favouring LF-9C more than offset the biological resource loss associated with LF-9C . LF-9C is, therefore, favoured for on-site impacts.

(b) Site Vicinity

LF-9C is preferred to LF-4N/PI-1N for site vicinity impacts. LF-4N/PI-1N is favoured for potential land use stability, potential disruption of adjacent and non-adjacent farm operations and fish and wildlife features of significance. LF-9C is favoured for all other site vicinity impacts where there are differences between the options.

Although the land use stability and fish and wildlife features of significance differences are distinct, as indicated by the factor suitability levels, both are low ranked factors. Land use stability is a secondary factor, used to temper other land use, economic, social and agricultural factors. Potential impacts on fish and wildlife features of significance are expected to be minor.

Potential community and recreation features, provincial plans and policies and restraints to dispersion impacts are also of limited importance. Community and recreation features in the site vicinity will experience effects similar to, but at a lower level than adjacent features. OWMC's commitment to mitigate potential impacts reduces the importance of this impact. The provincial policies and plans impacts are expected to be minimal. Minimal restraints to dispersion are expected for all siting options and can be mitigated if they occur. Major restraints were eliminated in earlier phases of the site selection process.

The principal tradeoff within the vicinity study area is, therefore, between the disruption of adjacent and non-adjacent farm operations favouring LF-4N/PI-1N, against social and land use impacts, partial displacement of farms and rare species, which favour LF-9C. The difference between the options for adjacent resident disruption is slightly greater than the disruption of adjacent farm operations difference. Both factors are ranked at the same level - level 10.

Disruption of non-adjacent farms is clearly greater with LF-9C. However, the combination of clearly greater impacts with LF-4N/PI-1N on property values, existing and planned and proposed land uses and, to a lesser extent non-adjacent residents, is sufficient to result in an overall preference for LF-9C.

(c) Community and Regional

LF-4N/PI-1N is preferred to LF-9C for community and regional impacts. LF-9C is clearly preferred for community character, municipal finance, existing and planned and proposed land uses and provincial policies and plans. All other major community and regional impacts favour LF-4N/PI-1N.

LF-9C is slightly favoured for community character. LF-4N/PI-1N is clearly preferred for social stability. Although both community and regional factors have the same factor rank, the difference between the siting options is greater in favour of LF-4N/PI-1N. LF-4N/PI-1N is, therefore, favoured for social impacts.

LF-9C is strongly preferred for municipal finance impacts. In addition, with LF-4N/PI-1N the potential conflict with the Region of Halton municipal landfill siting process could influence municipal services and finance. Municipal financial impacts are not, however, highly ranked. This ranking reflects the potential for mitigation and the OWMC commitment that no municipality will suffer financially. The community and regional economic base differences between the options slightly favour LF-4N/PI-1N.

The major tradeoff within the community and regional study area is between land use factors favouring LF-9C and the social and agricultural factors favouring LF-4N/PI-1N.

LF-4N/PI-1N is preferred for the following reasons:

- agricultural factors (i.e. stability of farm population, disruption to farm economy, stability of agricultural land base) are all ranked higher than the land use factors (existing land use, planned and proposed land use, provincial policies and plans);

- although the provincial plans and policies difference between the siting options is considerable (as indicated by the factor suitability levels), provincial policies and plans is a lower ranked factor (level 1). Potential impacts are expected to be minimal;

- existing and planned and proposed land use differences are moderate. Both siting options are located in primarily rural/vacant areas with some residential development and no industrial land use. Planned and proposed land use reflects existing land use patterns;

- the agricultural preference for LF-4N/PI-1N is reinforced by the social stability differences which also favour the Milton siting option.

(d) Access Roads

LF-4N/PI-1N is slightly preferred to LF-9C for access road impacts.

The major reasons for this preference include:

- the factors favouring LF-4N/PI-1N are generally more highly ranked than those factors favouring LF-9C. For example, the disruption of adjacent residents is a highly ranked factor because there is some potential for impacts such as noise and traffic disruption which may not be fully mitigable;

- the differences between the options for both adjacent and non-adjacent residents clearly favour LF-4N/PI-1N;

- there is a clear preference for LF-4N/PI-1N for existing and planned and proposed land uses;

- the disruption of community and recreation features in the access road vicinity is a very low ranked factor. These indirect impacts, which favour LF-9C, are expected to be very low to minor and to decrease with distance;

- the potential for and duration of impact on fish communities is expected to be low. If releases occur, mitigation is also possible through the institution of remedial measures to minimize serious biological impacts.

The reasons for preferring LF-4N/PI-1N are partially offset by the lower potential impacts on farm traffic and cattle crossings and adjacent and non-adjacent recreation features with LF-9C.

LF-4N/PI-1N is slightly preferred for access road impacts. The OWMC traffic volumes along the provincial and regional roads to LF-9C does, however, represent a very minor increment beyond existing traffic levels.

5.3.2.5 Tradeoffs Among Study Areas

LF-9C is preferred for overall impacts. LF-9C is favoured for site and site vicinity impacts. Community and regional and access roads impacts favour LF-4N/PI-1N.

The site impact differences between the two siting options clearly favour LF-9C. The site vicinity impacts favouring LF-9C are more minor. Both the community and regional and access road impacts favouring LF-4N/PI-1N are minor. The clear on-site differences and to a lesser extent, the site vicinity differences favouring LF-9C more than offset the community and regional and access road differences favouring LF-4N/PI-1N.

LF-9C is, therefore, preferred for overall impacts. The differences between the two options are, however, moderate.

5.3.2.6 Engineering Tradeoffs

The engineering differences between the siting options are listed in Table 5.14. The operating costs for these siting options are approximately equal. LF-4N/PI-1N has slightly lower capital costs. Both options provide an opportunity for the provision of rail service. LF-9C has somewhat greater landfill design type flexibility. LF-9C can accommodate conventional (site adapted), shallow entombed and above-ground landfill options. The shallow entombed landfill is not an option with LF-4N/PI-1N. The differences in landfill life are minor. Partial solidification* provides a landfill life in excess of 20 years for both siting options.

Aside from the somewhat greater landfill design type flexibility favouring LF-9C, there are no appreciable engineering differences between the two siting options.

5.3.2.7 Tradeoffs - Risks/Impacts/Engineering

Table 5.15 summarizes the major risk and impact conclusions. LF-9C is clearly favoured for overall risks and to a lesser extent for overall impacts. LF-9C also has somewhat greater landfill design flexibility. In this case, the engineering differences tend to reinforce the preference for LF-9C. LF-9C is, therefore, preferred to LF-4N/PI-1N.

TABLE 5.14

Engineering Differences

LF-9C vs. LF-4N/PI-1N

V2.241

Factor/Indicators	LF-9C	LF-4N/PI-1N
° Capital Costs	$192,085,000	$190,382,000
° Operating Costs	$ 42,500,000	$ 42,295,000
° Engineering Flexibility		
- rail access for additive reagents	yes	yes
- landfill design type	- conventional (site adapted) - shallow entombed - above ground	- conventional (site adapted) - above ground
- facility layout	rectangular	rectangular, modular
- operating area expansion potential (within acquisition area)	yes	yes
- alternative placement of stack location	yes	no
- landfill life (years)	total - 14 partial - 23.5	total - 15.5 partial - 24.5

TABLE 5.15

Summary of Conclusions for Risks and Impacts
LF-9C vs. LF-4N/PI-1N

	LF-9C	LF-4N/PI-1N
A. **RISK**		
° Transportation		0
° Air Quality	0	
° Hydrogeologic Suitability	0	
° Surface Water Suitability	–	–
Overall Risk	0	
B. **ENVIRONMENTAL IMPACTS**		
° Site	0	
° Site Vicinity	0	0
° Community and Regional		0
° Access Roads		
Overall Impacts	0	

0 = preferred

5.3.3 LF-4N/PI-1N VERSUS LF-1E/PI-27E

5.3.3.1 Introduction

This section compares the preferred Milton siting option (LF-4N/PI-1N) to the preferred Niagara Falls option (LF-1E/PI-27E). Tables C.11 and C.20 in Appendix C identify the major potential risks and impacts associated with these two siting options. The tables highlight the reasons for the identification of each major risk and impact.

5.3.3.2 Tradeoffs Within Risk Pathways

Table 5.16 lists the major risk differences between LF-4N/PI-1N and LF-1E/PI-27E. No or negligible differences are also listed. Table C.25 in Appendix C provides an elaboration of the magnitude and importance of these differences.

(a) Transportation

LF-4N/PI-1N is favoured for annual province-wide hazard based spills and accident involvements. LF-1E/PI-27E is preferred for spills and accident involvements on local and regional access roads because LF-1E/PI-27E is located in very close proximity to the QEW.

Transportation risks on local and regional roads are ranked higher than the risks on the province-wide system. The function of local and regional roads is less consistent with the haulage of dangerous goods. In addition, sensitive uses are closer to the road allowance. However, the province-wide risk differences favouring LF-4N/PI-1N are much greater than the local and regional risk differences favouring LF-1E/PI-27E.

TABLE 5.16

Summary of Major Risk Differences

LF-4N/PI-1N vs. LF-1E/PI-27E

RISK PATHWAY	DIFFERENCES FAVOURING LF-4N/PI-1N	DIFFERENCES FAVOURING LF-1E/PI-27E	NO OR NEGLIGIBLE DIFFERENCES[1]
• Transportation	• annual province-wide hazard-based spill index of OWMC generated transport • annual province-wide accident involvements of OWMC generated transport	• transportation risks on local and regional access roads due to accident involvements of OWMC generated transport	
• Air Quality	• risk from direct inhalation of emissions - chronic	• risk from direct inhalation of emissions - acute • risk from consumption of crops and livestock	
• Hydrogeologic Suitability		• capability of providing natural containment	• ground water use
• Surface Water Suitability		• potential for surface water use interference	• susceptibility of site to flooding

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[1] Differences screened from paired comparison

The local and regional access roads risk differences favouring LF-1E/PI-27E do not offset the more major province-wide system differences favouring LF-4N/PI-1N. LF-4N/PI-1N is, therefore, preferred for overall transportation risk.

(b) Air Quality

LF-4N/PI-1N is preferred for direct inhalation of emissions - chronic. LF-1E/PI-27E is favoured for acute exposure and for risks from the consumption of crops and livestock. The tradeoff between acute and chronic risks is an especially difficult one, as discussed in Chapter 4. In this case, the difference between the two siting options is the same for both factors. However, since LF-1E/PI-27E is also clearly preferred for risk from consumption of crops and livestock, LF-1E/PI-27E is preferred for overall air risk.

(c) Hydrogeologic Suitability

There are no hydrogeologic suitability tradeoffs. There is no ground water use difference between the siting options. LF-4N, LF-1E and PI-27E are all underlain by potentially productive aquifers. There is a clear preference for LF-1E/PI-27E for capability of providing natural containment. LF-4N/PI-1N is a marginal siting option because of the thin confining layer under both sites and the associated rapid contaminant breakthrough times to the underlying aquifer. Although LF-4N/PI-1N provides some natural containment, it is possible that the soils may not attenuate the potentially hazardous properties of the leachate. The potentially long breakthrough times associated with LF-1E/PI-27E provide a much greater opportunity for the natural attenuation of potential contaminants.

(d) Surface Water Suitability

There are no surface water suitability tradeoffs. There are no flooding susceptibility differences between the siting options. Constraints with both siting options are minor and mitigable.

However, LF-1E/PI-27E is clearly preferred for potential surface water use interference. LF-1E/PI-27E has the second lowest downstream water use index of all siting options with no potable uses immediately downstream. LF-4N/PI-1N has a moderate level of relative suitability with no potable uses immediately downstream, but a high downstream surface water use index (GLAL, 1985c, p.115).

LF-1E/PI-27E is, therefore, preferred for overall surface water risk.

5.3.3.3 Tradeoffs Among Risk Pathways

LF-4N/PI-1N is favoured for overall transportation risk. LF-1E/PI-27E is favoured for hydrogeologic, surface water suitability and air quality risk.

The tradeoff between overall transportation risks (favouring LF-4N/PI-1N) and natural containment (favouring LF-1E/PI-27E) is a difficult one. The thin confining layer and the relatively rapid breakthrough times associated with LF-4N/PI-1N means that although this siting option provides some natural containment, the soils may not attenuate the potentially hazardous properties of the leachate. Although with LF-1E/PI-27E there is some local variability uncertainty, the potentially long breakthrough times provide a much greater opportunity for the natural attenuation of potential contaminants. As a result, LF-4N/PI-1N is ranked lower than LF-1E/PI-27E. LF-4N/PI-1N is also a marginal siting option because of the short breakthrough times.

LF-4N/PI-1N is clearly favoured for overall transportation risks. However, as a result of previous site selection stages, particularly the narrowing of the search to the Golden Horseshoe, all the siting options have good regional access and all are close to the sources of waste. This clustering of siting options into a narrow band is reflected in the spill and accident involvement estimates for the entire access system. For predicted spills of hazardous special wastes, the estimates range from one spill every 7.2 years of operation for LF-4N/PI-1N to one spill every 5.4 years of operation for LF-1E/PI-27E. Thus, the probabilities of such events occurring are very low and the differences between options are limited. Moreover, from the perspective of potential consequences, the Milton siting option has a larger portion of its access system along local and regional roads. Uses along such roads tend to be closer to the edge of the road than with 400-series highways. The transportation of special wastes is also more consistent with the function of major highways than is the case with local and regional roads.

On the basis of the hydrogeologic and transportation risk considerations cited above, the Niagara Falls siting option is favoured. The surface water and air quality considerations, both of which represent moderate differences between the options, reinforce the preference for LF-1E/PI-27E.

5.3.3.4 Tradeoffs Within Study Areas

Table 5.17 lists the major impact differences between LF-4N/PI-1N and LF-1E/PI-27E. Factors for which there were no or negligible differences are also listed. Table C.26 in Appendix C provides an elaboration of the magnitude and importance of these differences.

(a) Site

LF-1E/PI-27E is slightly preferred to LF-4N/PI-1N for on-site impacts. LF-1E/PI-27E is favoured for displacement of historical, community and recreation features, planned and proposed land use and loss of farmland. LF-4N/PI-1N is favoured for displacement of residents and businesses, existing land use, rare species, natural vegetation displaced and potential for occurrence of other significant features.

Although LF-1E/PI-27E involves a greater displacement of residents, businesses and natural features, these differences are tempered somewhat by the industrial designation of PI-27E. Although there is a high probability

TABLE 5.17

Summary of Major Impact Differences

LF-4N/PI-1N vs. LF-1E/PI-27E

STUDY AREA	DIFFERENCES FAVOURING LF-4N/PI-1N	DIFFERENCES FAVOURING LF-1E/PI-27E	NO OR NEGLIGIBLE DIFFERENCES[1]
° Site	° displacement of residents ° displacement of businesses ° existing land use ° rare species ° natural vegetation displaced ° potential for occurrence of other significant features	° displacement of historical, community and recreation features ° planned and proposed land use ° loss of farmland	° land use stability
° Site Vicinity	° disruption of operations of community and recreation features (adjacent to site) ° disruption of operations of community and recreation features (site vicinity) ° land use stability ° existing land use ° significant environmental units (SEUs)	° property value impacts ° disruption of day-to-day activities and/or the use and enjoyment of property (adjacent to site) ° disruption of day-to-day activities and/or the use and enjoyment of property (non-adjacent) ° business activities positively affected by the presence of OWMC facilities ° planned and proposed land use	° business activities negatively affected by the presence of OWMC facilities ° rare species

[1] Differences screened from paired comparison

TABLE 5.17

Summary of Major Impact Differences
LF-4N/PI-1N vs. LF-1E/PI-27E

STUDY AREA	DIFFERENCES FAVOURING LF-4N/PI-1N	DIFFERENCES FAVOURING LF-1E/PI-27E	NO OR NEGLIGIBLE DIFFERENCES[1]
• Site Vicinity - Continued	• fish and wildlife features of significance • other natural vegetation • existing and anticipated air quality	° provincial policies and plans ° partial displacement of farms ° disruption of adjacent farm operations ° disruption of non-adjacent farm operations ° restraints to dispersion	
• Community and Regional	• social stability • social cohesion • tourism economy • tourism operations	° community character ° community and regional economic base ° planned and proposed land use ° existing land use ° provincial policies and plans ° stability of farm population ° stability of agricultural land base ° disruption to farm economy	

[1] Differences screened from paired comparison

TABLE 5.17

Summary of Major Impact Differences

LF-4N/PI-1N vs. LF-1E/PI-27E

STUDY AREA	DIFFERENCES FAVOURING LF-4N/PI-1N	DIFFERENCES FAVOURING LF-1E/PI-27E	NO OR NEGLIGIBLE DIFFERENCES[1]
• Access Roads		• disruption of day-to-day activities and/or the use and enjoyment of property (adjacent) • disruption of operations of community and recreation features (adjacent) • disruption of operations of community and recreation features (vicinity) • existing land use • planned and proposed land use • disruption to farm traffic and cattle crossings • fish communities	

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[1] Differences screened from paired comparison

of finding more rare species on LF-1E/PI-27E, these natural features may be displaced in the future with the industrial development of the site. The displacement of businesses is a low ranked factor and the businesses displaced at LF-1E/PI-27E can also be readily relocated.

No historical, community and recreation features are displaced with LF-1E/PI-27E. LF-4N/PI-1N involves the displacement of two significant features. These features can be readily relocated. OWMC has also made a commitment to mitigation. Consequently, the community and recreation features difference between the siting options is not a major consideration.

The principal tradeoff within the site study area is, therefore, between existing residents and businesses (favouring LF-4N/PI-1N) and planned and proposed land use and loss of farmland (favouring LF-1E/PI-27E). LF-1E/PI-27E is strongly favoured for farmland loss. The planned and proposed land use differences between the siting options is also important. The industrial designation on PI-27E is considered compatible with the proposed OWMC facility. LF-4N/PI-1N has generally agricultural land use designations and policies protective of agricultural land (LKA, 1985, Table H.6).

Overall, the farmland loss together with long-term land use compatibility, slightly outweighs the resident, business and natural feature displacement differences. The industrial designation of PI-27E is a key consideration with this conclusion. LF-1E/PI-27E is, therefore, slightly preferred for on-site impacts.

(b) Site Vicinity

LF-1E/PI-27E is preferred for site vicinity impacts. The differences favouring LF-4N/PI-1N (i.e. disruption of adjacent and non-adjacent community and recreation features) involve much lower ranked factors than those favouring LF-1E/PI-27E. Low levels of impact are anticipated and mitigative measures can also be instituted. The disruption of adjacent and non-adjacent residents, for which LF-1E/PI-27E is favoured, involve highly ranked factors. Impacts on residents are potentially serious, long-term and not fully mitigable. The impact on property values reinforces the preference for LF-1E/PI-27E. The Niagara Falls siting option is strongly favoured for positive business impacts. It is clearly favoured for planned and proposed land uses. There is substantial industrial and industrially designated land in the vicinity of LF-1E/PI-27E. Such is not the case with LF-4N/PI-1N. LF-1E/PI-27E is also clearly favoured for the three vicinity agricultural factors - partial displacement of farms, disruption of adjacent farm operations and disruption of non-adjacent farm operations - all highly ranked factors.

Land use stability impacts, which favour LF-4N/PI-1N, are not of high importance. Similarly, provincial plans and policies differences, although considerable, involve minimal and potentially mitigable impacts.

Although existing and anticipated air quality differences clearly favour LF-4N/PI-1N, the incremental effect on air quality, due to an OWMC facility, will be small. Similarly, the restraints to dispersion differences which favour LF-1E/PI-27E are minor and mitigable. The natural environmental factors also clearly favour LF-4N/PI-1N. Again, as reflected in the factor rankings, natural environmental impacts, which clearly favour LF-4N/PI-1N, are expected to be low and potentially mitigable.

In conclusion, the more severe and more highly ranked social, land use, business and agricultural factor impacts with LF-4N/PI-1N are not offset by the less severe and less highly ranked natural environment, land use and air quality factor impacts which favour LF-4N/PI-1N. As a result, LF-1E/PI-27E is preferred for site vicinity impacts.

(c) Community and Regional

LF-1E/PI-27E is preferred to LF-4N/PI-1N for community and regional impacts. Siting option LF-4N/PI-1N is preferred for social stability, social cohesion, tourism economy and tourism operations impacts. LF-1E/PI-27E is favoured for all other major impact differences.

The community and regional economic base, agricultural and land use impacts differences between the siting options clearly favour LF-1E/PI-27E. A greater number of jobs and households are expected to be created with the Niagara Falls siting option. The existing land use, planned and proposed land use and provincial policies and plans impact differences all clearly favour LF-1E/PI-27E. The existing and future land use for LF-4N/PI-1N is primarily rural/agricultural with no industrial lands. LF-1E/PI-27E has a mix of agricultural and industrial designations. Official plan policies for the PI-27E area encourage industrial development. As the land use report indicates: "This is the only siting option which offers the opportunity for a high degree of land use compatibility, both now and in the future, on the basis of the municipal official plan designation and adjacent heavy industrial lands" (LKA, 1985a, p.134). Although LF-4N/PI-1N potentially impacts both the Niagara Escarpment Plan and the Parkway Belt West Plan, anticipated impacts are expected to be minimal, and potentially mitigable.

There are major agricultural differences favouring LF-1E/PI-27E. The Niagara Falls siting option is located in a less stable agricultural area than LF-4N/PI-1N. It is also in close proximity to existing and designated industrial uses. "Agriculturally, it is more desirable to place the industrial facilities (incinerator and physical/chemical plant) on an industrial site away from active agriculture" (Ecologistics, 1985, p.163).

LF-4N/PI-1N is preferred for social stability and social cohesion impacts. LF-1E/PI-27E is preferred for community character impacts. Social stability and social cohesion are ranked at the same level. The difference between the two options is slightly greater for social stability, favouring LF-4N/PI-1N than for community character favouring LF-1E/PI-27E. This slight preference for LF-4N/PI-1N is reinforced by the less highly ranked, social cohesion preference for LF-4N/PI-1N. On balance, the social differences between the two options appear moderate.

Tourism in Niagara Falls is important to the Region and the Province. The magnitude of potential tourism impacts, however, appears limited. One of the tourism subconsultants, Laventhol & Horwath has estimated that the tourism image could be affected somewhat during a highly publicized hearing process (IER, 1985e). However, they have also noted that any decrease in tourism would be short-lived. Given that the potential location of the OWMC facility is some eight kilometres away from the Niagara Falls tourist focus and is in an area with existing heavy industry, it is the view of the social consultant, the Institute of Environmental Research Inc., that the net tourism impact will be minimal and short-term (IER, 1985a). The tourism report prepared by Laventhol and Horwath did, however, conclude that "Selection of either of the options involving the Niagara Falls sites, from a tourism perspective, could hold potentially serious implications" (IER, 1985e, p.152).

Overall, the strong agricultural, land use and economic base preference for LF-1E/PI-27E more than offsets the more moderate social preference and potentially less severe tourism impacts favouring LF-4N/PI-1N. LF-1E/PI-27E is, therefore, preferred for community and regional impacts.

(d) Access Roads

LF-1E/PI-27E is clearly favoured for all local and regional access road impacts. Access road impacts are low or negligible for LF-1E/PI-27E because of the relatively short distance travelled on local and regional access roads.

5.3.3.5 Tradeoffs Among Study Areas

There are no study area tradeoffs between the two options. LF-1E/PI-27E is clearly favoured for site, community and regional and access road impacts, and to a lesser degree, for site vicinity impacts.

5.3.3.6 Engineering Tradeoffs

The engineering differences between the siting options are listed in Table 5.18. Capital and operating costs are slightly lower for LF-1E/PI-27E. Both siting options provide an opportunity for the provision of rail service. There is no landfill flexibility difference between the siting options. Both landfill sites can accommodate conventional and above ground options. The shallow entombed option is not feasible with either siting option. LF-4N/PI-1N can accommodate both the rectangular and modular facility layouts. The rectangular layout is not an option with LF-1E/PI-27E.

There is somewhat greater flexibility for incinerator stack location with LF-1E/PI-27E. Stack location is more restricted with PI-1N because of the constraint with the Burlington Air Park (see Chapter 4, Volume 1). However, the issues of facility layout and stack location are not major concerns with either option.

LF-4N/PI-1N has somewhat greater landfill life, particularly with partial solidification.

LF-4N/PI-1N is, at best, slightly preferred to LF-1E/PI-27E based on somewhat lower capital and operating costs. These cost differences are, however, well within the level of accuracy[1] of the cost differences. There are no appreciable engineering flexibility differences between the options.

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[1] The engineering consultants indicated that the preliminary cost estimates were considered to have a level of accuracy within plus 30% and minus 18% (Monenco, 1986, p. 119).

TABLE 5.18

Engineering Differences

LF-4N/PI-1N vs. LF-1E/PI-27E

Factor/Indicators	LF-4N/PI-1N	LF-1E/PI-27E
° Capital Costs	$190,382,000	$194,002,000
° Operating Costs	$ 42,295,000	$ 46,398,000
° Engineering Flexibility		
- rail access for additive reagents	- yes	- yes
- landfill design type	- conventional (site adapted) - above ground (base case)	- conventional (site adapted) - above ground (base case)
- facility layout	- rectangular, modular	- modular
- operating area expansion potential (within acquisition area)	- yes	- yes
- alternative placement of stack location	- no	- yes
- landfill life (years)	- total 15.5 - partial 24.5	- total -11 - partial -19.5

5.3.3.7 Tradeoffs - Risks/Impacts/Engineering

Table 5.19 highlights the risk and impact conclusions.

LF-1E/PI-27E is clearly preferred for overall risks and impacts. The slight cost and flexibility differences favouring LF-4N/PI-1N are not sufficient to alter this preference.

5.3.4 LF-9C VERSUS LF-1E/PI-27E

5.3.4.1 Introduction

This section compares the preferred West Lincoln siting option (LF-9C) to the preferred Niagara Falls option (LF-1E/PI-27E). Tables C.26 and C.20 in Appendix C identify the major potential risks and impacts associated with these two siting options. The table highlights the reasons for the identification of each major risk and impact.

5.3.4.2 Tradeoffs Within Risk Pathways

Table 5.20 lists the major risk differences between LF-9C and LF-1E/PI-27E. No or negligible differences are also listed. Table C.27 in Appendix C provides an elaboration of the magnitude and importance of these differences.

(a) Transportation

LF-1E/PI-27E is preferred overall for transportation risk. LF-9C is favoured for annual province-wide hazard-based spills and accident involvements. LF-1E/PI-27E is preferred for risks on the local and regional component.

TABLE 5.19

Summary of Conclusions for Risks and Impacts
LF-4N/PI-1N vs. LF-1E/PI-27E

	LF-4N/PI-1N	LF-1E/PI-27E
A. RISK		
° Transportation	0	
° Air Quality		0
° Hydrogeologic Suitability		0
° Surface Water Suitability		0
Overall Risks		0
B. ENVIRONMENTAL IMPACTS		
° Site		0
° Site Vicinity		0
° Community and Regional		0
° Access Roads		0
Overall Impacts		0

0 = favoured

TABLE 5.20

Summary of Major Risk Differences

LF-9C vs. LF-1E/PI-27E

RISK PATHWAY	DIFFERENCES FAVOURING LF-9C	DIFFERENCES FAVOURING LF-1E/PI-27E	NO OR NEGLIGIBLE DIFFERENCES[1]
• Transportation	• annual province-wide accident involvements of OWMC generated transport • annual province-wide hazard-based spill index of OWMC generated transport	• transportation risks on local and regional access roads due to accident involvements of OWMC generated transport • transportation risks on local and regional access roads due to hazard-based spills of OWMC generated transport	
• Air Quality	• risk from direct inhalation of emissions - chronic • risk from direct inhalation of emissions - acute	• risk from consumption of crops and livestock	• risk from ingestion of cistern and pond water
• Hydrogeologic Suitability	• capability of providing natural containment		• ground water use
• Surface Water Suitability		• potential for surface water use interference	

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[1] Differences screened from paired comparison

LF-1E/PI-27E is located in close proximity to the QEW. LF-1E/PI-27E, therefore, has the lowest transportation risk values for spills and accident involvements on the local and regional access roads. Transportation risks on local and regional roads are ranked higher than the province-wide system. The function of the local and regional roads is less consistent with the haulage of dangerous goods than limited access highways such as the QEW. Sensitive uses also tend to be closer to the road allowance. As a result, the potential consequences of a spill tend to be more severe along local and regional roads. The local and regional road risk differences favouring LF-1E/PI-27E are greater than the province-wide risk differences favouring LF-9C.

In summary, the local and regional access differences favouring LF-1E/PI-27E more than offset the province-wide differences favouring LF-9C.

(b) Air Quality

With respect to air quality risk, LF-1E/PI-27E is favoured for risks from the consumption of crops and livestock. LF-9C is preferred for direct inhalation of emissions, both chronic and acute risks. LF-9C is preferred overall for the following reasons:

- risks from direct inhalation of emissions are more highly ranked factors than indirect pathway factors;

- the generic risk assessment indicates that direct exposure pathways produce more severe effects than indirect exposure pathways (Environ, 1985);

- the potential for mitigation is limited for the direct pathways. Measures can be taken to monitor contaminant levels associated with crops and livestock. Remedial action can then be taken prior to long-term risk to human health;

- LF-1E/PI-27E has greater values for existing and future population exposure for fugitive emissions (chronic) and for existing and future population exposure for upset emissions from the incinerator stack.

(c) **Hydrogeologic Suitability**

There are no hydrogeologic suitability tradeoffs. There are no ground water use differences between the siting options. There is a clear preference for LF-9C for capability to provide natural containment. The confining layer with LF-9C is laterally continuous and uniformly thick. As a result, the contaminant breakthrough times to the underlying aquifer are long. Predictability of geologic conditions at LF-9C is rated as uniform. LF-1E/PI-27E also has potentially long contaminant breakthrough times. However, there is some uncertainty associated with LF-1E/PI-27E as a result of a moraine feature to the southeast of LF-1E and buried sand under the northwest portion of PI-27E. As a result of the buried sand underlying the northwestern portion of PI-27E and the possibility that the moraine feature southeast may extend under the sites, predictability of geologic conditions at LF-1E/PI-27E is rated as locally variable. Contaminant breakthrough times have also been rated as variable. The uncertainties at LF-1E/PI-27E may be removed with additional drilling. However, because of variable conditions which exist in the vicinity of the two Niagara Falls sites, residual uncertainty after detailed drilling would remain greater at LF-1E/PI-27E than with LF-9C.

(d) **Surface Water Suitability**

There are no surface water suitability tradeoffs. There is a clear preference for LF-1E/PI-27E for potential for surface water use interference. However, the surface water risk differences are minor, as indicated by the relatively low factor suitability levels. In both cases, there are no local stream takings for potable supply.

5.3.4.3 Tradeoffs Among Risk Pathways

LF-9C is favoured for air quality and hydrogeologic suitability risks. LF-1E/PI-27E is favoured for transportation and surface water risks.

As previously indicated, the surface water differences are minor. Since there is some potential for leachate migration related to the ground/surface water connection, the primary consideration is natural containment rather than surface water use.

The hydrogeologic suitability differences are quite substantial, as reflected in the factor suitability level differences between the two options. Although steps can be taken to reduce the uncertainties associated with the Niagara Falls options, a clear preference for LF-9C would remain because of the more variable conditions in the vicinity of the Niagara Falls siting options. This preference is reinforced by the clear air quality risk preference for LF-9C. Also, as described in Chapter 6, when additional weight is attached to the direct air risk pathways, the gap between the two options widens.

As a result of previous site selection decisions, all siting options have good regional access and are close to the sources of waste. The siting options are clustered together into a narrow band, as reflected in the spills and accident involvements estimates.

As described in Chapter 6, depending on how the local and regional access roads are defined, a case can be made for suggesting that the transportation risks are at least as great with LF-1E/PI-27E and possibly greater.

Overall, the clear air quality and hydrogeologic suitability differences favouring LF-9C more than offset the transportation and surface water preferences for LF-1E/PI-27E. LF-9C is, therefore, preferred to LF-1E/PI-27E for overall risk.

5.3.4.4 Tradeoffs Within Study Areas

Table 5.21 lists the major impact differences between LF-9C and LF-1E/PI-27E. Factors for which there are no or negligible impacts are also

TABLE 5.21

Summary of Major Impact Differences

LF-9C vs. LF-1E/PI-27E

STUDY AREA	DIFFERENCES FAVOURING LF-9C	DIFFERENCES FAVOURING LF-1E/PI-27E	NO OR NEGLIGIBLE DIFFERENCES[1]
° Site	° displacement of residents ° displacement of businesses ° existing land use ° natural vegetation displaced ° potential for occurrence of other significant features	° planned and proposed land use ° land use stability	° rare species ° loss of farmland
° Site Vicinity	° property value impacts ° business activities negatively affected by the presence of OWMC facilities ° disruption of operations of community and recreation features (adjacent to site) ° disruption of operations of community and recreation features (site vicinity) ° existing land use ° partial displacement of farms ° significant environmental units (SEUs)	° disruption of day-to-day activities and/or the use and enjoyment of property (adjacent to site) ° disruption of day-to-day activities and/or the use and enjoyment of activities (non-adjacent) ° business activities positively affected by the presence of OWMC facilities ° planned and proposed land use ° land use stability ° disruption of adjacent farm operations	

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[1] Differences screened from paired comparison

TABLE 5.21

Summary of Major Impact Differences

LF-9C vs. LF-1E/PI-27E

STUDY AREA	DIFFERENCES FAVOURING LF-9C	DIFFERENCES FAVOURING LF-1E/PI-27E	NO OR NEGLIGIBLE DIFFERENCES[1]
• Site Vicinity - Continued	• fish and wildlife features of significance • other natural vegetation • rare species • existing and anticipated air quality	• disruption of non-adjacent farm operations	
• Community and Regional	• social stability • social cohesion • municipal finance • tourism economy • tourism operations	• community character • community and regional economic base • planned and proposed land use • stability of farm population • stability of agricultural land base • disruption to farm economy	• existing land use
• Access Roads		• disruption of day-to-day activities and/or the use and enjoyment of property (adjacent)	

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[1] Differences screened from paired comparison

TABLE 5.21

Summary of Major Impact Differences

LF-9C vs. LF-1E/PI-27E

STUDY AREA	DIFFERENCES FAVOURING LF-9C	DIFFERENCES FAVOURING LF-1E/PI-27E	NO OR NEGLIGIBLE DIFFERENCES[1]
• Access Roads - Continued		° disruption of day-to-day activities and/or the use and enjoyment of property (vicinity) ° disruption of operations of community and recreation features (adjacent) ° disruption of operations of community and recreation features (vicinity) ° existing land use ° planned and proposed land use ° disruption to farm traffic and cattle crossings ° fish communities	

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[1] Differences screened from paired comparison

listed. Table C.28 in Appendix C provides an elaboration of the magnitude and significance of these differences.

(a) Site

Site LF-9C is clearly preferred to LF-1E/PI-27E for on-site impacts. LF-1E/PI-27E is favoured for planned and proposed land use and for land use stability. LF-9C is preferred for the displacement of residents and businesses, existing land use and all natural environment factors, with the exception of rare species. There are no rare species or loss of farmland differences between the siting options.

LF-1E/PI-27E involves a much greater displacement of residents and natural features than does LF-9C. These differences are tempered somewhat by the industrial designation of PI-27E and by the greater land use stability of LF-9C. LF-9C is also favoured for displacement of businesses. The businesses displaced with the Niagara Falls siting option can, however, be readily relocated. Natural environment features to be displaced with LF-1E/PI-27E are not significant.

(b) Site Vicinity

There is a clear preference for LF-1E/PI-27E for the more highly ranked social and agricultural factors, i.e. disruption of adjacent and non-adjacent residents, and disruption of adjacent and non-adjacent farm operations. This preference is reinforced by a number of more moderately ranked socio-economic factors, including planned and proposed land use, land use stability and businesses positively affected by the OWMC facility.

The greater partial displacement of farms with LF-1E/PI-27E does not offset the clear agricultural preference for the Niagara Falls siting option. Similarly, existing land use, the community and recreation feature, property value impacts and negative business differences favouring LF-9C fail to offset the clear agricultural, social and business preference for LF-1E/PI-27E.

The two factor groupings favouring LF-9C are natural environment and air dispersion/air quality. In both cases, the factors receive low to moderate rankings - a reflection of the limited impacts anticipated. Changes in air quality, as a result of facility emissions, are expected to be very small.

Overall, the clear socio-economic preference for LF-1E/PI-27E is not offset by the more moderate natural environmental and air quality impacts favouring LF-9C.

(c) Community and Regional

LF-1E/PI-27E is preferred to LF-9C for community and regional impacts. Within the existing land use factor, there are offsetting differences between the siting options. LF-9C is preferred for social stability, social cohesion, municipal finance, tourism economy and tourism operations. LF-1E/PI-27E is preferred for all other major impact differences.

The difference between the siting options is approximately the same for municipal finance and community and regional economic base. The community and regional economic base factor favouring LF-1E/PI-27E is ranked higher than the municipal finance factor, resulting in a slight preference for LF-1E/PI-27E.

The social factor differences exhibit a moderate preference for LF-9C. The two more highly ranked social factors - social stability and community character - favour LF-9C and LF-1E/PI-27E, respectively. The community character differences favouring LF-1E/PI-27E are greater than the social stability differences favouring LF-9C. Social cohesion is not ranked as highly as the other two social factors. This moderate social preference for LF-9C is offset by a clear proposed and planned land use preference for LF-1E/PI-27E.

The future land use for LF-9C is predominantly agricultural with minor residential clusters and no industrial lands. LF-1E/PI-27E has generally agricultural land use designations with substantial industrially designated areas. Official plan policies for the Niagara Falls siting option encourage industrial development. As the land use report indicates: "This is the only siting option which offers the opportunity for a high degree of land use compatibility, both now and in the future, on the basis of the municipal official plan designation and adjacent heavy industrial lands" (LKA, 1985a, p.134).

The final tradeoff is, therefore, between tourism economy and tourism operations impacts favouring LF-9C, as compared with agricultural differences favouring LF-1E/PI-27E.

The agricultural differences favouring LF-1E/PI-27E involve highly ranked factors and the difference between the options is considerable. The factor suitability level differences between the siting options range from -3.6 for disruption to farm economy to -2.2 for stability of agricultural land base. The Niagara Falls siting option is located in a less stable agricultural area than LF-9C. LF-1E/PI-27E is also in close proximity to existing and designated and proposed industrial areas. From an agricultural perspective, it is better to locate an industrial facility away from an active agricultural area (Ecologistics, 1985, p.163).

As previously described, the social consultant concluded potential tourism impacts are likely to be minor in severity and short-lived. LF-1E/PI-27E is an existing heavy industry area, well removed (some eight kilometres) from the Niagara Falls tourist focus. In contrast, LF-9C is centrally located in an active agricultural area. One of the tourism subconsultants, Laventhol and Horwath, however, indicated that selection of a Niagara Falls siting option would have potentially serious implications. The industrial nature of the OWMC facility is much more consistent with the pattern of uses in the vicinity of LF-1E/PI-27E than with the agricultural uses surrounding LF-9C.

On the basis of the above, LF-1E/PI-27E is preferred to LF-9C for overall community and regional impacts.

(d) Access Roads

LF-1E/PI-27E is clearly preferred for potential local and regional access road impacts. Local and regional access road impacts are low or negligible for LF-1E/PI-27E because of the site's immediate proximity to the QEW.

5.3.4.5 Tradeoffs Among Study Areas

LF-1E/PI-27E is preferred for overall impacts. The site impact preference for LF-9C is more than offset by the site vicinity, access road, community and regional preferences for LF-1E/PI-27E.

5.3.4.6 Engineering Tradeoffs

The engineering differences between the siting options are listed in Table 5.22. Capital and operating costs are slightly lower for LF-9C. Both siting options provide an opportunity for the provision of rail service. Both landfill sites can accommodate site adapted conventional and base case above ground options. The shallow entombed option is not feasible with LF-1E. LF-1E/PI-27E can accommodate the modular layout. LF-9C can accommodate the rectangular options. This difference is not major because there is no overriding preference for either layout option. Both options have the flexibility for operating area expansion and alternative placement for the stack location. The landfill lives are somewhat longer for LF-9C, particularly with partial solidification.

There is a distinct engineering preference for LF-9C. This siting option had somewhat lower capital and operating costs, greater flexibility for landfill design and somewhat greater landfill life.

TABLE 5.22

Engineering Differences

LF-9C vs. LF-1E/PI-27E

Factor/Indicators	LF-9C	LF-1E/PI-27E
° Capital Costs	$192,085,000	$194,002,000
° Operating Costs	$ 42,500,000	$ 46,398,000
° Engineering Flexibility		
- rail access for additives/ reagents	- yes	- yes
- landfill design type	- conventional (site adapted) - shallow entombed - above ground	- conventional (site adapted) - above ground
- facility layout	- rectangular	- modular
- operating area expansion potential (within acquisition area)	- yes	- yes
- alternative placement of stack location	- yes	- yes
- landfill life (years)	- total 14 - partial 23.5	- total -11 - partial -19.5

5.3.4.7 Tradeoffs - Risks/Impacts/Engineering

Table 5.23 highlights the risk and impact conclusions.

The final choice involves a difficult tradeoff between the risk differences favouring LF-9C and the impact differences favouring LF-1E/PI-27E.

As a result of the steps taken in facility design and operations, and through previous site selection stages, risk levels may be quite low. The hydrogeologic uncertainty might potentially be reduced through additional drilling at LF-1E/PI-27E. Risk differences between the two siting options may be moderate. Overall, it might then be argued that the possibly low absolute risk levels, together with the moderate risk differences, are more than offset by the impact differences favouring LF-1E/PI-27E.

Counter-balancing these considerations, risk minimization is OWMC's most highly ranked goal. Even with additional drilling at LF-1E/PI-27E, there remains a residual hydrogeologic suitability uncertainty. Although very conservative assumptions have been employed in the generic risk assessment, some prediction of risk and mitigation uncertainties remain. A prudent approach is to reduce potential risks further by selecting the site with the lowest relative and absolute risks. Finally, the selection of LF-1E/PI-27E necessitates additional drilling of both LF-1E/PI-27E and LF-9C (in case the Niagara Falls siting option proves unacceptable).

In addition to the above considerations, there is a distinct engineering preference for LF-9C. LF-9C has somewhat lower capital and operating costs, greater flexibility for landfill design and somewhat greater landfill life. As previously noted, engineering considerations are viewed to be secondary to risk and impact concerns. They do, however, reinforce the case for LF-9C.

TABLE 5.23

Summary of Conclusions for Risks and Impacts

LF-9C vs. LF-1E/PI-27E

	LF-9C	**LF-1E/PI-27E**
A. Risk		
° Transportation		0
° Air Quality	0	
° Hydrogeologic Suitability	0	
° Surface Water Suitability		0
Overall Risk	0	
B. Environmental Impacts		
° Site	0	
° Site Vicinity		0
° Community and Regional		0
° Access Roads		0
Overall Impacts		0

0 = favoured

5.4 CROSS-CHECK - LF-1E VERSUS LF-9C

5.4.1 INTRODUCTION

As previously noted, the risk and impact differences between LF-1E and LF-1E/PI-27E are limited and subject to conflicting interpretations. As a final cross-check, LF-1E was compared to the preferred West Lincoln option LF-9C. A similar comparison has not been undertaken between LF-1E and LF-4N/PI-1N because the risk and impact differences between LF-1E/PI-27E and LF-4N/PI-1N are much more pronounced than those between LF-1E/PI-27E and LF-9C.

Tables C.16 and C.17 in Appendix C identify the major potential risks and impacts associated with these two siting options. The table highlights the reasons for the identification of each major risk and impact.

5.4.2 TRADEOFFS WITHIN RISK PATHWAYS

Table 5.24 lists the major risk differences between LF-9C and LF-1E. No or negligible differences are also listed. Table C.29 in Appendix C provides an elaboration of the magnitude and importance of these differences.

(a) Transportation

LF-1E is preferred for transportation risk. LF-9C is favoured for annual province-wide hazard-based spills and accident involvements. LF-1E is preferred for risks on the local and regional component of the transportation system.

LF-1E is located in close proximity to the QEW. As a result, LF-1E has the second lowest transportation risk values for local and regional access roads spills and for accident involvements. Transportation risks on local and regional roads are ranked higher than the province-wide system. The function of the local and regional roads is less consistent with the haulage of special waste.

TABLE 5.24

Summary of Major Risk Differences

LF-9C vs. LF-1E

RISK PATHWAY	DIFFERENCES FAVOURING LF-9C	DIFFERENCES FAVOURING LF-1E	NO OR NEGLIGIBLE DIFFERENCES[1]
• Transportation	• annual province-wide accident involvements of OWMC generated transport • annual province-wide hazard-based spill index of OWMC generated transport	• transportation risks on local and regional access roads due to accident involvements of OWMC generated transport • transportation risks on local and regional access roads due to hazard-based spills of OWMC generated transport	
• Air Quality	• risk from direct inhalation of emissions - chronic • risk from direct inhalation of emissions - acute • risk from ingestion of cistern and pond water	• risk from consumption of crops and livestock	
• Hydrogeologic Suitability	• capability of providing natural containment		• ground water use
• Surface Water Suitability		• potential for surface water interference	

[1] Differences screened from paired comparison

LF-1E is located in close proximity to the QEW. As a result, LF-1E has the second lowest transportation risk values for local and regional access roads spills and accident involvements. Transportation risks on local and regional roads are ranked higher than the province-wide system. The function of the local and regional roads is less consistent with the haulage of dangerous goods. Sensitive uses also tend to be closer to the road allowance with local and regional roads. The potential for a spill in close proximity to residents and other sensitive uses would tend to be greater with LF-9C. The local and regional access road component of the total transportation system is much greater with LF-9C than with LF-1E. The difference between the siting options for local and regional road risk is greater than the province-wide magnitude of difference.

The local and regional access road differences favouring LF-1E more than offset the province-wide differences favouring LF-9C.

(b) Air Quality

LF-1E is favoured for consumption of crops and livestock. LF-9C is preferred for direct chronic and acute inhalation of emissions, and for ingestion of cistern and pond water. LF-9C is preferred for overall air quality risk because:

- the direct inhalation of emission factors are more highly ranked than indirect pathway factors;

- the generic risk assessment indicates that direct exposure pathways produce more severe effects than any of the indirect exposure pathways (Environ, 1985);

- the potential for mitigation is more limited for the direct pathways. Measures can be taken to monitor contaminant levels associated with crops and livestock. Remedial action can be taken prior to long-term risk to human health;

- the ingestion of cistern and pond water suitability differences between the two siting options are substantial - a 3.5 factor suitability level difference;

- LF-1E has higher existing and future population exposure values for incinerator stack emissions (chronic) and for relative existing and future population exposure for upset emissions from the incinerator stack and from low elevation sources (acute).

(c) Hydrogeologic Suitability

There are no hydrogeologic suitability tradeoffs. There are no ground water use differences between the siting options. There is a clear preference for LF-9C for natural containment capability. The confining layer with LF-9C is laterally continuous and uniformly thick. The contaminant breakthrough times to the underlying aquifers are long. Predictability of geologic conditions with LF-9C is rated as uniform.

LF-1E has potentially long breakthrough times, although not as long as those associated with LF-9C. However, there is some uncertainty associated with LF-1E as a result of a moraine feature to the southeast of the site. As the hydrogeology report indicates, "Confining layer thins to extinction under southeastern portion of site as a result of a local morainal feature. Sand layers associated with the moraine could be present within the confining layer under the site" (GLAL, 1985b, p.80). These sand layers could act as a pathway for off-site leachate migration. Geologic conditions predictability has been rated as locally variable at LF-1E. Contaminant breakthrough times have been rated as variable.

There is some potential for reducing these uncertainties with additional drilling of LF-1E. However, because of variable conditions which exist in the vicinity of the Niagara Falls site, the uncertainty at LF-1E would continue to remain greater than with LF-9C.

(d) Surface Water Suitability

There are no surface water suitability tradeoffs. There is a clear preference for LF-1E for potential for surface water use interference. However, the surface water risk differences are minor, as indicated by the relatively low factor suitability levels. In both cases, there are no local stream takings for potable supply.

5.4.3 TRADEOFFS AMONG RISK PATHWAYS

LF-9C is favoured for air quality and hydrogeologic suitability. LF-1E is favoured for overall transportation and surface water risk.

All siting options have good regional access. The six siting options are also close to the sources of waste. As a result, the siting options are clustered together in a narrow transportation risk band. This pattern is reflected in the estimated number of spills and accident involvements.

As previously indicated, the surface water differences are minor. Since there is some potential for leachate migration related to the ground/surface water connection, the primary consideration is natural containment rather than surface water use.

The hydrogeologic suitability differences are quite substantial as reflected in the factor suitability differences between the two options. Although steps can be taken to reduce the uncertainties with the Niagara Falls options, the clear preference for LF-9C would remain. This preference is reinforced by the clear air quality risk preference for LF-9C. As described in Chapter 6, when additional weight is attached to the direct air risk pathways, the gap between the two options widens.

Overall, the clear hydrogeology and air quality suitability differences favouring LF-9C more than offset the transportation and surface water preference for LF-1E.

5.4.4 TRADEOFFS WITHIN STUDY AREAS

Table 5.25 lists the major impact differences between LF-9C and LF-1E. Factors for which there are no or negligible impacts are also listed. Table C.30 in Appendix C provides an elaboration of the magnitude and significance of these differences.

(a) Site

LF-9C is clearly preferred to LF-1E for on-site impacts. LF-9C has less displacement of residents, businesses, farms with on-site headquarters and natural vegetation, existing land use impacts and potential for occurrence of other significant features. In all cases, the factor suitability level differences favouring LF-9C are 1.0 or greater.

LF-1E is clearly preferred to LF-9C for rare species. The West Lincoln siting option has high potential rare plant and animal species impacts. The resource loss is not, however, significant. The extent of dependence of the rare animal species on LF-9C remains to be determined (GLAL, 1985a, p.97).

The potential biological natural resource loss associated with LF-9C does not offset the other major advantages favouring LF-1E.

(b) Site Vicinity

LF-1E is preferred for site vicinity impacts. The more highly ranked social and agricultural factors, i.e. adjacent and non-adjacent residents, and adjacent and non-adjacent farms, exhibit a clear preference for LF-1E. This preference is reinforced by the greater land use stability with LF-1E.

TABLE 5.25

Summary of Major Impact Differences

LF-9C vs. LF-1E

STUDY AREA	DIFFERENCES FAVOURING LF-9C	DIFFERENCES FAVOURING LF-1E	NO OR NEGLIGIBLE DIFFERENCES[1]
• **Site**	• displacement of residents • displacement of businesses • existing land use • displacement of farms with on-site headquarters • loss of farmland • natural vegetation displaced • potential for occurrence of other significant features	• rare species	• planned and proposed land use • land use stability
• **Site Vicinity**	• property value impacts • disruption of operations of community and recreation features (site vicinity) • existing land use • partial displacement of farms • significant environmental units (SEUs) • other natural vegetation	• disruption of day-to-day activities and/or use and enjoyment of property (adjacent to site) • disruption of day-to-day activities and/or the use and enjoyment of property (non-adjacent) • land use stability • disruption of adjacent farm operations • disruption of non-adjacent farm operations	• disruption of operations of community and recreation features (adjacent to site) • planned and proposed land use • fish and wildlife features of significance • existing and anticipated air quality

---

[1] Differences screened from paired comparison

TABLE 5.25

Summary of Major Impact Differences

LF-9C vs. LF-1E

STUDY AREA	DIFFERENCES FAVOURING LF-9C	DIFFERENCES FAVOURING LF-1E	NO OR NEGLIGIBLE DIFFERENCES[1]
• Community and Regional	° social stability ° social cohesion ° municipal finance ° tourism economy	° community character ° community and regional economic base ° existing land use ° planned and proposed land use ° stability of farm population ° stability of agricultural land base ° disruption to farm economy	
• Access Roads		° disruption of day-to-day activities and/or the use and enjoyment of property (adjacent) ° disruption of day-to-day activities and/or the use and enjoyment of property (vicinity) ° disruption of operations of community and recreation features (adjacent)	

---

[1] Differences screened from paired comparison

TABLE 5.25

Summary of Major Impact Differences

LF-9C vs. LF-1E

STUDY AREA	DIFFERENCES FAVOURING LF-9C	DIFFERENCES FAVOURING LF-1E	NO OR NEGLIGIBLE DIFFERENCES[1]
• Access Roads - continued		° disruption of operations of community and recreation features (vicinity) ° existing land use ° planned and proposed land use ° disruption to farm traffic and cattle crossings ° fish communities	

---

[1] Differences screened from paired comparison

The greater partial displacement of farms with LF-1E does not offset the clear agricultural preference for the Niagara Falls siting option. Similarly, the greater site vicinity, community and recreation features, existing land use and property value impacts with LF-1E do not offset the overall socio-economic preference for LF-1E.

Natural environmental and air quality considerations both favour LF-9C. In both cases, the differences between the options are moderate. The natural environmental factors in the site vicinity have low rankings. These low rankings reflect the limited impacts anticipated. The air quality factor ranking is also moderate.

Overall, the socio-economic preference for LF-1E is not offset by the moderate natural environmental and air quality impact differences favouring LF-9C.

(c) Community and Regional

LF-1E is preferred to LF-9C for community and regional impacts. LF-9C is preferred for social stability, social cohesion, municipal finance and impacts on the tourism economy. LF-1E is preferred for all other major impact differences.

The difference between the siting options is approximately the same for municipal finance and community and regional economic base. The community and regional economic base factor is ranked higher than the municipal finance factor. Thus, for the combination of economic base and municipal finance, LF-1E is preferred.

There is a clear preference for LF-1E for both existing and planned and proposed land use. There are no industrial or industrially designated areas within the community and regional study area of LF-9C. In contrast, there are a range of existing industrial uses and designated industrial areas within the LF-1E community and regional study area. Thus, with LF-1E, there are a range of existing industrial uses and designated industrial areas within the LF-1E community and regional study area. Thus, with LF-1E, there is an opportunity to locate the facility in an area characterized by similar industrial-type uses.

LF-1E is also strongly preferred from an agricultural perspective. All three agricultural factors clearly favour LF-1E. This preference reflects the greater intensity of agricultural activity surrounding LF-9C. The area surrounding LF-1E has a much lower proportion of agricultural employment, sales and land use.

The social and tourism factors favour LF-9C. In the case of the social factors, the two more highly ranked factors (social stability and community character) favour LF-9C and LF-1E, respectively. The difference is approximately the same for the two factors. The overall social preference for LF-9C is a reflection of the preference for LF-9C for the more moderately ranked social cohesion factors.

There is a clear tourism economy preference for LF-9C. However, as previously noted, the social consultant concluded that potential tourism impacts were expected to be moderate in severity and short-lived[1]. LF-1E is close to existing and future industrial uses, some eight kilometres from the Niagara Falls tourist focus. In contrast, LF-9C is located in a stable and active agricultural area.

Overall, the moderate social differences and moderate tourism impacts favouring LF-9C do not offset the strong land use and agricultural preference for LF-1E. LF-1E is, therefore, preferred to LF-9C for the community and regional study area.

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[1] One of the tourism consultants, Laventhol and Horwath, did, however, conclude that the Niagara Falls sites could hold potentially serious implications for tourism (IER, 1985e, p.152).

(d) Access Roads

There are no access road tradeoffs. LF-1E is clearly preferred for potential local and regional access road impacts. Access road impacts are low or negligible for LF-1E because of its immediate proximity to the QEW.

5.4.5 TRADEOFFS AMONG STUDY AREAS

LF-1E is preferred for overall impacts. LF-9C is favoured for on-site impacts. LF-1E is favoured for the other three study areas.

The site impact differences clearly favour LF-9C. The access road impacts strongly favour LF-1E. The site vicinity and community and regional study areas differences, although more moderate, clearly favour LF-1E.

In conclusion, the strong access road and, to a lesser extent, site vicinity and community and regional preference for LF-1E is not offset by the clear site impacts preference for LF-9C.

5.4.6 ENGINEERING TRADEOFFS

The engineering differences between the siting options are listed in Table 5.26. The capital costs for these siting options are approximately equal. LF-9C has slightly lower operating costs. Both options provide for a rail service opportunity. Both siting options can accommodate conventional and above-ground landfill options. The shallow entombed option is not feasible with LF-1E. LF-1E has the flexibility to accommodate both modular and rectangular facility layouts. Only the modular option is feasible with LF-9C. This difference is not major. There is no overriding preference for either layout option. Both options can provide for operating area expansion and alternative placement for the stack location. The landfill lives are somewhat longer for LF-9C, particularly with partial solidification as the treatment option. However, with partial solidification a landfill life in excess of 20 years can be achieved.

TABLE 5.26

Engineering Differences

LF-9C vs. LF-1E

Factor/Indicators	LF-9C	LF-1E
° Capital Costs	$192,085,000	$192,066,000
° Operating Costs	$ 42,500,000	$ 45,354,000
° Engineering Flexibility		
- rail access for additives/ reagents	- yes	- yes
- landfill design type	- conventional (site adapted) - shallow entombed - above ground	- conventional (site adapted) - above ground
- facility layout	- rectangular	- modular, rectangular
- operating area expansion potential (within acquisition area)	- yes	- yes
- alternative placement of stack location	- yes	- yes
- landfill life (years)	- total 14 - partial 23.5	- total 12 - partial 21

There is a distinct overall engineering preference for LF-9C. This siting option has greater landfill design flexibility and landfill life.

5.4.7 TRADEOFFS - RISKS/IMPACTS/ENGINEERING

Table 5.27 highlights the risks and impact conclusions.

The final analysis involves a similar set of tradeoffs to the LF-9C - LF-1E/PI-27E comparison. In both paired comparisons a difficult tradeoff must be made between the risk differences favouring LF-9C and the impact differences favouring LF-1E.

As a result of the steps taken in facility design and operations, and through previous site selection stages, risk levels are expected to be quite low. The hydrogeologic uncertainty might be reduced through additional drilling at LF-1E. Risk differences between the two siting options may be moderate. Thus, it might be argued that the low absolute risks and the moderate risks differences are more than offset by the impact differences favouring LF-1E. As compared with the LF-1E/PI-27E - LF-9C comparison, the risk differences between LF-9C and LF-1E are more limited. Depending on the importance attached to the industrial designation of PI-27E and to the site and site vicinity impacts on existing residents, the impact differences between LF-1E and LF-9C are either less than or greater than the impact differences between LF-9C and LF-1E/PI-27E.

Counter-balancing these considerations, risk minimization is OWMC's most highly ranked goal. Even with additional drilling at LF-1E, there remains a residual hydrogeologic suitability uncertainty. Although very conservative assumptions have been employed in the generic risk assessment, risk prediction and mitigation uncertainties remain. Finally, the selection of LF-1E necessitates the drilling of both LF-1E and LF-9C (in case the Niagara Falls siting option proves unacceptable).

TABLE 5.27

Summary of Conclusions for Risks and Impacts

LF-9C vs. LF-1E

	LF-9C	LF-1E
A. RISK		
° Transportation		0
° Air Quality	0	
° Hydrogeologic Suitability	0	
° Surface Water Suitability		0
Overall Risk	0	
B. ENVIRONMENTAL IMPACTS		
° Site	0	
° Site Vicinity		0
° Community and Regional		0
° Access Roads		0
Overall Impacts		0

0 = favoured

There is a distinct engineering preference for LF-9C. Although engineering considerations are secondary to impact and risk concerns, they reinforce the case for LF-9C.

It is evident from the above that the major arguments for and against the Niagara Falls and West Lincoln options do not change when LF-1E is employed in the comparison with LF-9C, rather than LF-1E/PI-27E.

5.5 CONCLUDING COMMENTS

The paired comparisons with siting options within geographic clusters resulted in the following conclusions:

i) Milton: LF-4N/PI-1N is clearly preferred over LF-4N/PI-13N for risk and impacts. This conclusion is also supported by engineering considerations although the differences are slight.

ii) West Lincoln: LF-9C is marginally preferred over LF-3C for risks. LF-9C is clearly preferred over LF-3C for impacts. There are no appreciable engineering differences between the two options.

iii) Niagara Falls: LF-1E is slightly preferred over LF-1E/PI-27E for risks. There is a clear preference for LF-1E/PI-27E for impacts. There is a slight engineering preference for LF-1E. Overall the clear impact differences more than offset the slight risk and engineering differences. The overall differences, are however, limited and could be subject to conflicting interpretations.

The paired comparisons of siting options among geographic clusters resulted in the following conclusions:

i)	Milton: (LF-4N/PI-1N) vs. West Lincoln (LF-9C)	LF-9C is preferred to LF-4N/PI-1N for both risks and impacts. There is a clear preference for LF-9C for risks. The preference for LF-9C for impacts is moderate. There are no appreciable engineering differences between the two siting options.
ii)	Milton: (LF-4N/PI-1N) vs. Niagara Falls (LF-1E/PI-27E)	LF-1E/PI-27E is clearly preferred over LF-4N/PI-1N for both risks and impacts. The slight cost and flexibility differences favouring LF-4N/PI-1N are not sufficient to alter this preference.
iii)	West Lincoln: (LF-9C)[1] vs. Niagara Falls (LF-1E/PI-27E	LF-9C is clearly preferred over LF-1E/PI-27E for risks. LF-1E/PI-27E is clearly preferred over LF-9C for impacts. There is a slight engineering preference for LF-9C. A case can be made for the selection of either siting option. The selection of the preferred option is dependent on the importance attached to risks and impacts in general and on the interpretations of particular risk, impact and cost/flexibility considerations associated with the two options.

The cross-check between LF-1E (Niagara Falls) and LF-9C (West Lincoln) resulted in the following conclusions:

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[1] OWMC concluded that LF-9C was preferred over LF-1E/PI-27E as indicated in the OWMC Phase 4A report, (OWMC, 1985).

- LF-9C is clearly preferred over LF-1E for risks. LF-1E is clearly preferred over LF-9C for impacts. In both cases, the differences between LF-9C and LF-1E are more limited than those between LF-9C and LF-1E/PI-27E. There is a distinct engineering preference for LF-9C.

- As in the previous comparison, the choice of a preferred siting option is dependent on the importance attached to risks and impacts in general as well as on interpretations of the individual risks and impacts associated with the two siting options.

6.0 SYNTHESIS OF DISCIPLINARY PERSPECTIVES

6.1 INTRODUCTION

6.1.1 BACKGROUND AND PURPOSE

As described in Volume 1, the Phase 4A site selection process was undertaken by a team of consultants. Each consultant was responsible for synthesizing their analyses and interpretations and for ranking the siting options. This ranking procedure gave each consultant the opportunity to derive an overall disciplinary/professional perspective. The synthesis processes undertaken by the individual consultants are documented in each consultant's technical report. This chapter integrates the disciplinary/professional perspectives of the individual site selection consultants.

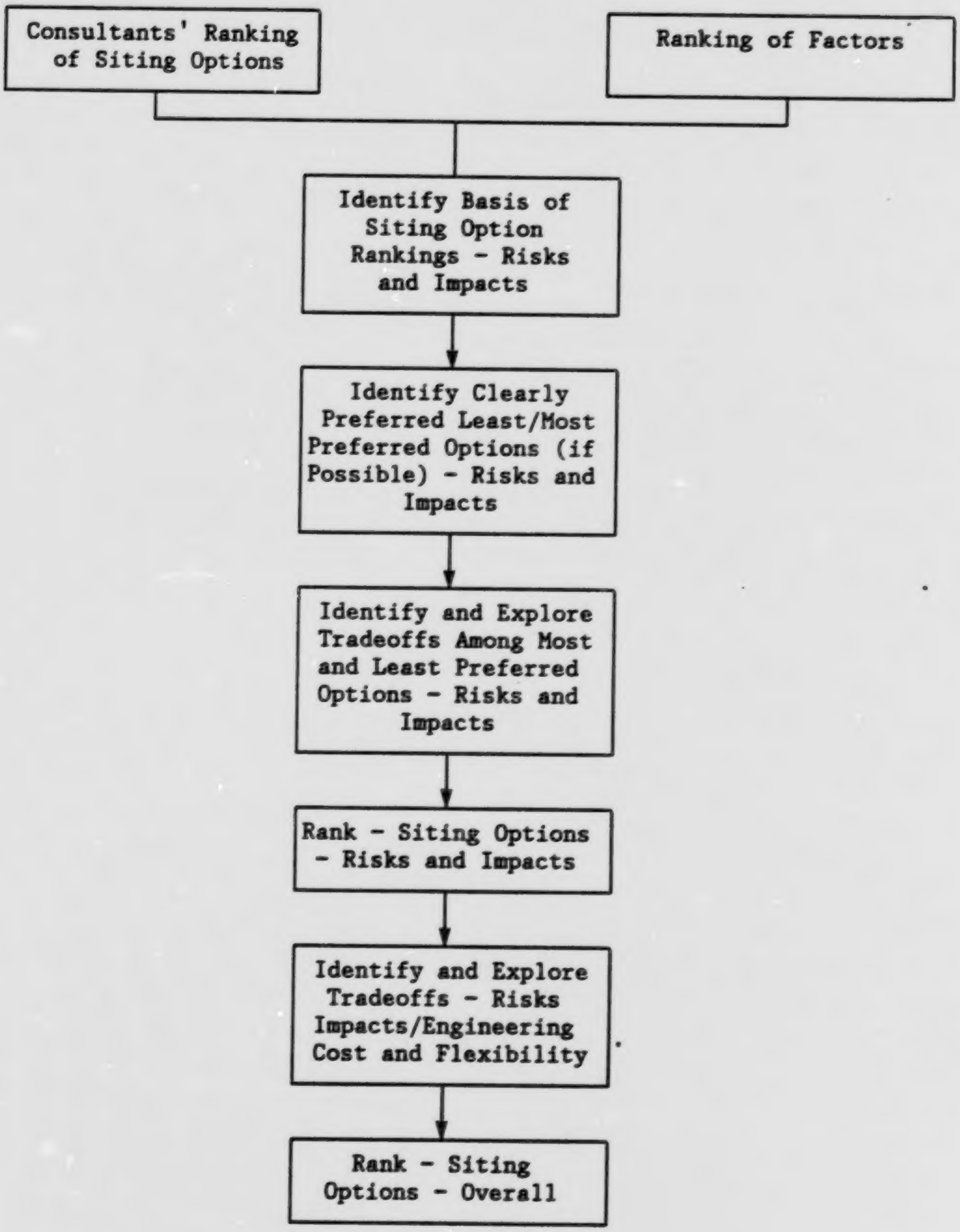
This synthesis was prepared by the site selection coordinating consultant - M.M. Dillon Limited. It does, however, draw upon the reasoning and interpretations contained in the individual site selection reports and obtained from the site selection team.

6.1.2 SITING OPTION RANKING PROCESS

The process by which the siting options were ranked is illustrated in Figure 6.1. The process began with the rationales for the ranking of siting options prepared by the consultants, together with the overall ranking of factors. The consultants were also asked to specify, to the extent that

FIGURE 6.1

Process for Siting Option Ranking


Consultants' Ranking of Siting Options
Ranking of Factors
Identify Basis of Siting Option Rankings - Risks and Impacts
Identify Clearly Preferred Least/Most Preferred Options (if Possible) - Risks and Impacts
Identify and Explore Tradeoffs Among Most and Least Preferred Options - Risks and Impacts
Rank - Siting Options - Risks and Impacts
Identify and Explore Tradeoffs - Risks Impacts/Engineering Cost and Flexibility
Rank - Siting Options - Overall

they could, the magnitude and significance of the differences among ranking levels.

The disciplinary integration process was split into two streams of activities - one concerned with risks to human health and the other with environmental impacts. In both activity streams, the synthesis process began with a review of the basis for the consultants' siting option rankings.

As with factor ranking, options clearly preferred or not preferred were first identified. To the extent that siting option rankings by the various consultants were similar, various perspectives were mutually supportive. However, instances of conflicting rankings among disciplines were also identified. Whenever such conflicts were identified, they were evaluated. The evaluation of such conflicts or tradeoffs drew upon the analyses and interpretations contained in various consultants' reports. It also involved a review of points and perspectives expressed in discussions with other site selection consultants.

Once overall risk and impact siting option rankings were derived, the tradeoffs among the risk, impact and engineering cost and flexibility rankings were evaluated.

6.1.3 CHAPTER FORMAT

This chapter reflects the process illustrated in Figure 6.1. After describing the approach, a rationale for the risk and then the impact rankings is presented. The risk and impact rankings are then reviewed. Finally, engineering cost and flexibility considerations are added and an evaluation of risk, impact and engineering cost and flexibility tradeoffs is presented.

6.2 APPROACH

6.2.1 MAJOR DISTINCTIONS

This disciplinary evaluation procedure is a systematic qualitative evaluation of the advantages and disadvantages of the six siting options. In evaluating the various arguments for and against different positions, a series of important distinctions are made. These distinctions include the following:

- Absolute Risks and Impacts

  The constraints associated with some siting options are more than a reflection of position relative to other siting options. They may also vary in severity when viewed within a broader geographic context. One of the siting options may, for example, be hydrogeologically acceptable, but still marginal in terms of what the hydrogeology consultant considers to be adequate or acceptable. In contrast, the air quality consultant may consider all siting options to have very limited air dispersion constraints, although there may be considerable variations in suitability across the siting options. Absolute risks and impacts pertain to the comparison of the siting options against more general standards of suitability rather than only relative to one another. When addressing different tradeoffs among options, this broader perspective can assume an important role in the final conclusions.

- Relative Risks and Impacts

  Relative risks or impacts pertain to the magnitude and importance of risk and impact differences between and among siting options. Relative risk and impact interpretations involve differences both within and between disciplines.

- **Mitigation Potential**

  The potential to prevent or reduce risks and impacts plays an important role in the determination of siting option rankings. In some instances, as in the excavation of archaeological resources and for municipal financial impacts, impacts are mitigable. In such instances, constraints can be avoided through construction procedures, by site-specific design or operational changes, or through the institution of mitigation or compensation policies. However, in most instances, it is a question of interpreting, for each siting option, whether there appears to be mitigation potential, whether the mitigative measures could be readily undertaken, and what the likely effectiveness of the potential mitigative measures might be. In these cases, interpretations must be made regarding whether there appears to be the potential for reducing potential risks or impacts through facility characteristics' changes or OWMC policy initiatives.

- **Uncertainty**

  Through the course of preparing risk and impact predictions, there are inevitably some uncertainties regarding predictions of the magnitude of risks and impacts and, with respect to interpretations of the significance of various aspects of the environment and the extent to which they are affected. There are also likely to be uncertainties regarding the need for and potential effectiveness of various mitigative measures. These uncertainties might pertain to different aspects of the affected environment (existing and future), to site-specific design and operations, or to the interaction between the environment and the facility. These areas of uncertainty have a bearing on interpretations of potential risks and impacts and, in turn, on the resulting siting option rankings. A "conservative" approach is employed. Essentially this means that uncertainty interpretations reflect a desire not to underestimate potential risks or impacts.

- Policy

  A further distinction pertains to policy. Policy refers to both OWMC policy and to the policies of other government agencies. Examples of pertinent OWMC policies include ensuring a second level of natural protection and ensuring no municipality will suffer financially. An example of a site-specific municipal policy is the official plan designation of a site.

- Factor Rankings

  In some instances the choice between siting options depends on factor rankings. Where pertinent, differences in factor rankings are included in the evaluation of tradeoffs between options.

6.2.2 THE INTERPRETATION OF RELATIVE DIFFERENCES

Chapter 7 of this Volume addresses relative differences among options in a quantitative manner. This chapter represents a qualitative evaluation of differences among options. In reaching conclusions regarding whether the collective arguments favour one option or another, consideration is given to such quantitative information as the consultants' suitability levels, the factor rankings and various physical measurements and predictions. However, the determination of siting option rankings also involves the consideration of such qualitative information as judgements regarding absolute and relative differences, mitigation potential, uncertainty and policy concerns.

In addition to the use of quantitative procedures, the individual site selection consultants frequently describe differences through the use of such relative terms as "slight", "minor", "major" and "moderate". The interpretation of differences involves a review of both the quantitative and qualitative distinctions drawn by the consultants.

For the purpose of this analysis, differences across disciplines are characterized by the following three level system:

- Slight or Minor Differences

  This distinction refers to situations where differences are so small that:

  - they are close to negligible; or

  - a strong case can be made for either option with preferences being reversed with only minor shifts in the importance attached to various site selection factors.

- Clear or Moderate Differences

  In this situation, although the overall differences appear moderate, a clear preference is evident.

- Major or Strong Preference Differences

  This distinction refers to situations where the differences strongly favour one option.

6.2.3 SENSITIVITY ANALYSES

Chapter 8 contains a large number of analyses undertaken to determine the sensitivity of siting option rankings to alternative facilities characteristics assumptions and factor weights. Although most of these sensitivity analyses are confined to Chapter 8, consideration is given to a small number of sensitivity analyses especially pivotal to addressing key tradeoffs among siting options. The sensitivity analyses addressed in a summary fashion in this chapter include the following:

- the sensitivity analysis undertaken by the Ontario Research Foundation which placed a greater weight on direct air pathways;
- the sensitivity analysis undertaken by M.M. Dillon Ltd., together with the Institute of Environmental Research Inc. and Leon Kentridge Associates Ltd., which redefined the local and regional access road system to include portions of the QEW unique to particular option(s);
- the sensitivity analysis undertaken by Monenco Ltd. which incorporated a series of engineering flexibility considerations into the comparative evaluation process.

6.2.4 TABLE AND TEXT FORMAT

The arguments for and against each siting option, or various pairs of siting options, have been summarized in a series of tables. These tables include the following columns:

- discipline - e.g. hydrogeology, surface water;
- distinctions - The distinctions identified in Section 6.2.1 are noted, i.e. absolute risk, relative risk, mitigation potential, uncertainty, policy, factor ranking. In each case, a dot is placed in the column appropriate to the argument;
- preference - Where an argument favours one option over another, the option number is listed, e.g. 3C. In a case where the argument supports a no difference conclusion, the letters "ND" have been entered

in the column. Where the argument supports narrowing the differences between options, the letters "LD" for limiting difference, are employed;

- reasons/comments - The final column provides the summary arguments. In some instances consultants' rankings and predictions are used to highlight arguments. The arguments in favour of the overall disciplinary preference are presented first. Then the counter, limiting, and no difference arguments are presented.

The summary tables provide the basis for the conclusions and summary rationale presented in the text. As described in Section 6.1.2, the text is structured to initially group siting options into levels, i.e. clearly most or least suitable and then to evaluate the differences among siting options. Options are compared two at a time to simplify the evaluation of tradeoffs.

6.3 SYNTHESIS OF RANKINGS BY RISK CONSULTANTS

6.3.1 INTRODUCTION

Table 6.1 highlights the ranking of siting options by the four risk consultants or disciplines. Table D.1 in Appendix D provides a more detailed synopsis of the rationale for the rankings. This report section traces the risk synthesis process.

The synthesis process began with a review of the siting options to determine if any option was clearly favoured over the remaining options. No siting option was identified as clearly preferred over the remaining options. The only siting option consistently ranked among the top three siting options was LF-1E. However, surface water is the only discipline for which LF-1E is preferred. As the surface water factors are ranked somewhat

TABLE 6.1

Ranking of Siting Options By Risk Disciplines[1]

Rankings	Consultants			
	Transportation	Hydrogeology	Air	Surface Water[2]
	(M.M. DILLON)	(GLAL)	(ORF)	(GLAL)
1	LF-4N/PI-13N	LF-3C	LF-3C	LF-1E
2	LF-4N/PI-1N	LF-9C	LF-9C and LF-1E	LF-1E/PI-27E
3	LF-1E and LF-1E/PI-27E	LF-1E and LF-1E/PI-27E	-	LF-9C
4	-	-	LF-1E/PI-27E	LF-4N/PI-1N
5	LF-9C	LF-4N/PI-1N	LF-4N/PI-1N	LF-3C
6	LF-3C	LF-4N/PI-13N	LF-4N/PI-13N	LF-4N/PI-13N

[1] This table ranks the siting options from most to least preferred. The magnitude and significance of differences between siting options is described in the text which follows and is summarized in Table D.1 in Appendix D.

[2] The surface water ranking excludes transportation risks as these risks have been incorporated into the transportation risk analysis.

lower than the remaining risk factors, the tradeoffs among the remaining factors were evaluated before reaching any conclusions.

As there were no clearly preferred options, it was, therefore, decided to progressively exclude the relatively less desirable siting options. This process is illustrated in Figure 6.2.

The process began with the identification of the options clearly not preferred in terms of overall risk. A comparative analysis of the remaining siting options was then undertaken. This process was conducted in a series of steps. Each of these steps resulted in the exclusion of one siting option. This process was continued until a preferred siting option was selected. This process also resulted in an overall ranking of siting options.

6.3.2 LEAST PREFERRED OPTIONS

(a) Introduction

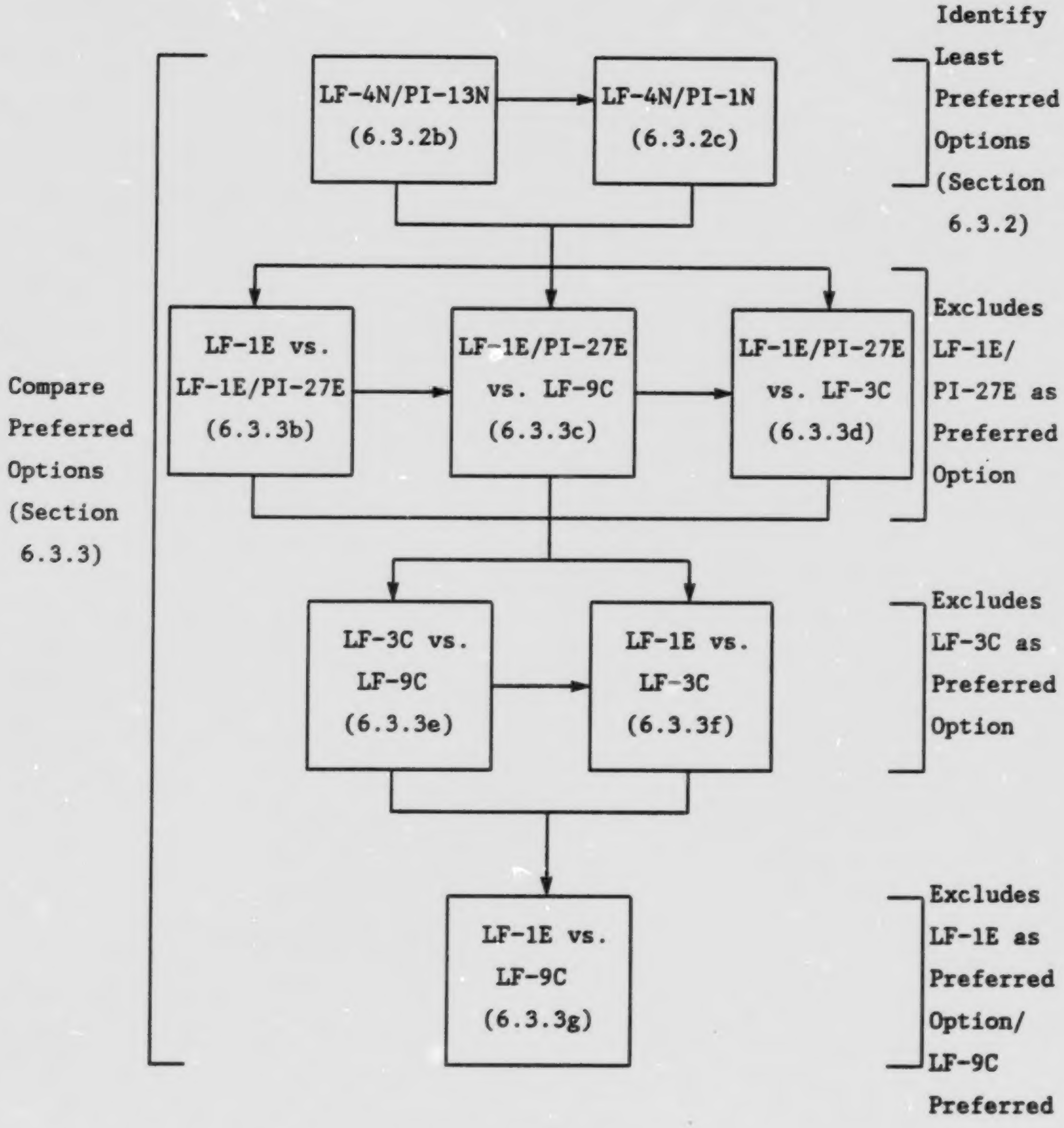
Two options, LF-4N/PI-1N and LF-4N/PI-13N receive low rankings for three of the four risk disciplines. The comparative evaluation process begins with a review of these two options to determine if either option should be ranked higher than one or more of the remaining options.

(b) LF-4N/PI-13N

As indicated in Table 6.1, LF-4N/PI-13N is the least preferred siting option for three risk disciplines. LF-4N/PI-13N is preferred from a transportation perspective. The major tradeoff between the two options concerns whether the transportation risk advantages of LF-4N/PI-13N outweigh the collective disadvantages posed by the other risk disciplines.

FIGURE 6.2

Risk Siting Option Ranking Steps


LF-4N/PI-13N (6.3.2b)
LF-4N/PI-1N (6.3.2c)
Identify Least Preferred Options (Section 6.3.2)
LF-1E vs. LF-1E/PI-27E (6.3.3b)
LF-1E/PI-27E vs. LF-9C (6.3.3c)
LF-1E/PI-27E vs. LF-3C (6.3.3d)
Excludes LF-1E/ PI-27E as Preferred Option
Compare Preferred Options (Section 6.3.3)
LF-3C vs. LF-9C (6.3.3e)
LF-1E vs. LF-3C (6.3.3f)
Excludes LF-3C as Preferred Option
LF-1E vs. LF-9C (6.3.3g)
Excludes LF-1E as Preferred Option/ LF-9C Preferred

LF-4N/PI-13N is the least desirable siting option (see Table 6.2) for the following reasons:

- PI-13N fails to provide natural containment. This conclusion was reached late in the site selection process. LF-4N/PI-13N was, therefore, included in the comparative evaluation process. However, a failure to provide natural containment, even after mitigation, contradicts the OWMC policy of ensuring a second level of natural protection. This constraint, by itself, is sufficient to reject LF-4N/PI-13N.

- LF-4N/PI-13N is hydrogeologically the least desirable siting option. The inability to ensure natural containment represents a major difference between LF-4N/PI-13N and the remaining options.

- LF-4N/PI-13N is the least desirable option for the air discipline. There is a clear difference between LF-4N/PI-13N and the fifth ranked option, LF-4N/PI-1N. Even under the alternative weighting system where the direct risk factors are weighted more highly[1], LF-4N/PI-13N is ranked fifth. There is only a slight difference between LF-4N/PI-13N and the sixth ranked siting option - LF-1E/PI-27E - under the alternative weighting system.

- LF-4N/PI-13N is the least desirable option for the surface water discipline. Again, there is a clear difference between LF-4N/PI-13N and the next lowest ranked option. The high degree of surface water use, with LF-4N/PI-13N, is a particular concern because, with the absence of natural containment, there is a greater potential for ground/surface water connections.

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[1] The Ontario Research Foundation undertook an alternative weighting of risk indicators. With this procedure, a logarithmic scale was used to reflect more precisely the differences between various direct and indirect air quality factors as identified in the generic risk assessment (Environ, 1985).

TABLE 6.2

Summary Arguments - Risk Rankings - LF-4N/PI-13N

DISCIPLINE	CRITERIA 1	2	3	4	5	6	REASONS/COMMENTS
Hydrogeology	0						° site fails to provide natural containment-fails basic acceptability screen
			0				° even by adjusting the depth of excavation, "would be expected to locally penetrate the confining layer" (GLAL, 1985b, p.85)
		0					° low rating - ground water use - absence of suitable alternative ground water supply and potential for aquifer expansion
		0					° lowest ranked option - hydrogeologic suitability
						0	° capability to provide natural containment - one of highest ranked factors (level 10)
				0			° insufficient data re. leachate characteristics to assume not hazardous
			0				° cannot assume long-term effectiveness of mitigative measures - on or off-site
					0		° OWMC policy that sites should offer a second level of protection
				0			° level of confidence in hydrogeologic analysis adequate to warrant conclusion that fails to ensure second level of protection
Transportation		0					° most highly ranked siting option
	0						° differences between LF-4N/PI-1N and LF-4N/PI-13N close to negligible; LF-4N/PI-1N retained

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking

TABLE 6.2

Summary Arguments - Risk Rankings - LF-4N/PI-13N

DISCIPLINE	CRITERIA						REASONS/COMMENTS
	1	2	3	4	5	6	
Transportation (continued)	0						° differences among options for spills posing potential risk to human health and fatal or personal injury accidents for total transportation system too small to be statistically significant
						0	° transportation - one of the highest ranked factors (level 10)
		0					° strong preference for Milton options based on aggregated transportation risk value -55.4 vs -84.0 (LF-1E and LF-1E/PI-27E), -137.0 (LF-9C) and -152.0 (LF-3C)
	0						° transportation risks on a province-wide basis greatly reduced during previous site selection stages by, for example, the restriction of the site selection process to the Golden Horseshoe area
			0				° potential to reduce transportation risk in general and especially along local and regional roads
Air		0					° ranked as least desirable option; clear difference from next lowest ranked option (-2.9 vs -3.2); relatively highly ranked for population exposure indices for stack and fugitive emissions-existing and future populations, topographic constraints (Sixteen Mile Creek), low elevation - upset emissions - existing and future population, crop exposure to fugitive emissions
						0	° one of highest ranked factors (level 9); direct pathways
			0	0			° highly ranked - acute emissions - direct exposure - such pathways have greatest uncertainty and least amenable to mitigation

Legend:

1 - Absolute Risk and Impacts	4 - Uncertainty
2 - Relative Risk and Impacts	5 - Policy
3 - Mitigation	6 - Factor Ranking

TABLE 6.2

Summary Arguments - Risk Rankings - LF-4N/PI-13N

DISCIPLINE	CRITERIA						REASONS/COMMENTS
	1	2	3	4	5	6	
Air (continued)		0					° with alternative weight scheme LF-4N/PI-13N ranked fifth, slightly better than LF-1E/PI-27E, the sixth ranked option
Surface Water		0					° ranked as least preferred siting option; potable water uses downgradient from facilities and high downstream water use index (GLAL, 1985c, p.122)
			0	0			° greater level of uncertainty and mitigation more difficult with unacceptable natural containment - ground/surface water connections

Legend:

1 - Absolute Risk and Impacts	4 - Uncertainty
2 - Relative Risk and Impacts	5 - Policy
3 - Mitigation	6 - Factor Ranking

- Although LF-4N/PI-13N is the preferred siting option, from a transportation perspective, the differences between LF-4N/PI-13N and LF-4N/PI-1N are slight. LF-4N/PI-1N satisfies the hydrogeologic basic acceptability screen. It also received higher air and surface water discipline rankings. There are, therefore, no appreciable disadvantages (from a transportation perspective) in ranking LF-4N/PI-13N as sixth, providing the tradeoff between transportation and other risk disciplines are fully reviewed in the comparison between LF-4N/PI-1N and the remaining siting options.

(c) LF-4N/PI-1N

LF-4N/PI-1N is ranked fifth out of six for two disciplines - hydrogeology and air. It is ranked fourth for a third discipline - surface water. LF-4N/PI-1N is, however, ranked second by the transportation discipline. The major risk tradeoff concerns whether the transportation advantages possessed by LF-4N/PI-1N are sufficient to offset its disadvantages for the other risk disciplines. Table 6.3 highlights the summary arguments pertinent to the risk ranking of LF-4N/PI-1N. LF-4N/PI-1N is ranked fifth for overall risk. The rationale for this conclusion is as follows:

- With relatively short contaminant breakthrough times to the underlying aquifer, even after mitigation, LF-4N/PI-1N is hydrogeologically marginal in an absolute sense and is the least desirable of the remaining options (after LF-4N/PI-13N).

- The air discipline ranking for LF-4N/PI-1N is fifth. There is a clear difference between LF-4N/PI-1N and the fourth ranked option. With the alternative weighting scheme LF-4N/PI-1N is ranked fourth. However, there are only minor differences between LF-4N/PI-1N and the fifth (LF-4N/PI-13N) and the sixth (LF-1E/PI-27E) ranked options.

- LF-4N/PI-1N is ranked fourth overall for surface water use. The flooding constraint at the site is not considered significant.

TABLE 6.3

Summary Arguments - Risk Rankings - LF-4N/PI-1N

DISCIPLINE	DISTINCTIONS						REASONS/COMMENTS
	1	2	3	4	5	6	
Hydrogeology	0						• marginal as a result of very short breakthrough times
	0		0				• breakthrough times for LF-4N before mitigation 1 to 68 years; after mitigation 57 to 150 years
	0						• limited breakthrough times for PI-1N - 28 to 29 years - potentially less than operating life of facility; leak might not be detected until after decommissioning
				0			• uncertainty re. off-site connections through two sand layers under LF-4N; LF-4N "is underlain by two sand layers which have aquifer potential and appear to have off-site continuity" (GLAL, 1985b, p.99)
		0					• lowest ranked option (after LF-4N/PI-13N)
		0					• aquifer capable of meeting more stringent water use requirements (GLAL, 1985b, p.91)
				0			• limited breakthrough times and uncertainties regarding sand layers when combined with general uncertainties regarding leachate quality, ground water flow, contaminant transport and the potential for long-term mitigation result in lowest siting option ranking (excluding LF-4N/PI-13N)
						0	• one of highest ranked factor (level 10)
Transportation	0						• transportation risks on a province-wide basis greatly reduced during previous site selection stages by, for example, the restriction of the site selection process to the Golden Horseshoe area

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking

TABLE 6.3

Summary Arguments - Risk Rankings - LF-4M/PI-1M

DISCIPLINE	DISTINCTIONS						REASONS/COMMENTS
	1	2	3	4	5	6	
Transportation (continued)		0					• differences among options for spills posing potential risk to human health and in terms of fatal or personal injury accidents for total transportation system too small to be statistically significant
						0	• transportation - one of highest ranked factors (level 10)
		0					• strong preference for Milton options based on aggregated transportation risk value -58.4 vs -84.0 (Niagara Falls) vs -137.0 (LF-9C) and -152.0 (LF-3C)
			0				• potential to reduce transportation risk in general and especially along local and regional roads
Air		0					• ranked fifth - air risk - reflection of high existing and future population exposure index for incinerator stack and fugitive emissions, topographic constraints to acute emissions dispersion (Sixteen Mile Creek), high existing and future population exposure - upset emissions - incinerator, relatively large number of community facilities with 5 km and relatively high crop exposure
		0					• clear difference from fourth ranked option (LF-1E/PI-27E); ORF suitability levels -2.9 vs -2.5
						0	• high factor ranking (level 9) for direct air factors
		0	0	0			• highly ranked - acute emissions - direct exposure - such factors have greatest uncertainty and more limited opportunity for mitigation.
Surface Water	0						• ranked fourth - surface water risk - attributable to relatively high level of downstream water use

Legend:

1 - Absolute Risk and Impacts	4 - Uncertainty
2 - Relative Risk and Impacts	5 - Policy
3 - Mitigation	6 - Factor Ranking

TABLE 6.3

Summary Arguments - Risk Rankings - LF-4N/PI-1N

DISCIPLINE	DISTINCTIONS 1	2	3	4	5	6	REASONS/COMMENTS
Surface Water (continued)			0	0			° greater level of uncertainty and mitigation more difficult with marginal natural containment - ground/surface water connections

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking

Downstream water use is slightly greater than that of the more highly ranked options. This constraint is more of a concern because of potential ground/surface water connections. Viewed in this manner, the gap between LF-4N/PI-1N and the third ranked option (LF-9C) widens. The surface water constraints at LF-4N/PI-1N, therefore, reinforce a low overall risk ranking for LF-4N/PI-1N.

- LF-4N/PI-1N is strongly preferred to the West Lincoln and Niagara Falls options from a transportation risk perspective. Transportation factors are highly ranked because of the severity of potential effects in the event of exposure and because mitigation cannot be considered fully effective. This preference is not sufficient to offset the risk disadvantages possessed by LF-4N/PI-1N. The reasons for this conclusion include the following:
  - the frequency of major transportation risks on a province-wide basis has been greatly reduced during previous site selection stages by, for example, the restriction of the site selection process to the Golden Horseshoe. As a result, the potential frequency of spills and accidents has been reduced;
  - when comparing the siting options in terms of the range of spills posing a risk to human health (1 every 5.1 to 1 every 7.5 years) and the range of fatal or personal injury accidents involvements (1 every 1.6 to 1 every 2.6 years) the differences across the siting options are too small to be statistically significant (MMD, 1985b, pp.237 and 241).
- There is potential for reducing transportation risk both in general and on a site-specific basis. Measures to reduce transportation risk include vehicle design requirements, operating requirements, such as the time of day of transport, driver training, road improvements and special requirements for most special wastes.

- The narrow transportation frequency risk range across the siting options contrasts with a wide hydrogeologic risk range across the siting options. The very short breakthrough times (and consequently limited natural containment) contrasts with the very long breakthrough times associated with the West Lincoln sites and with the potentially very long breakthrough times associated with the Niagara Falls options. These hydrogeology/ transportation risk differences result in a preference for the other options over LF-4N/PI-1N. This preference is reinforced by the clear air discipline and surface water disadvantages associated with LF-4N/PI-1N.

In conclusion, the transportation risk preference for LF-4N/PI-1N is not sufficient to offset its major hydrogeologic, surface water and air discipline disadvantages. LF-4N/PI-1N is therefore less desirable than all other siting options, with the exception of LF-4N/PI-13N.

6.3.3 PREFERRED OPTIONS

(a) Introduction

After identifying the two options (LF-4N/PI-1N and LF-4N/PI-13N), not likely to be the preferred option, the next step begins by comparing and ranking the remaining four options from an overall risk perspective. This process involves a series of paired comparisons. LF-1E is clearly preferred to LF-1E/PI-27E. The process of preferred comparing the four remaining options, therefore, begins with the comparison of LF-1E and LF-1E/PI-27E.

(b) LF-1E versus LF-1E/PI-27E

These two options are ranked at the same level for transportation and hydrogeologic risks. LF-1E is favoured for both the air and surface water disciplines. Table 6.4 highlights the summary arguments relevant to the comparative evaluation of LF-1E and LF-1E/PI-27E. The differences between the options are, in the case of surface water, slight. In the case of the air discipline, the differences are moderate. The rationale for the conclusion that the differences between the two options are slight overall is as follows:

- Both options have the same surface water suitability level - level 1. The difference between the options is a minor readily mitigable flooding constraint.
- The differences in the air consultant's suitability levels (-2.3 versus -2.5) is also limited. This slight difference is reinforced by the low absolute risks identified in the generic risk assessment. When the alternative weighting scheme (which weighed direct pathways more highly) is employed, the differences are moderate rather than minor.

(c) LF-1E/PI-27E versus LF-9C

Having concluded that LF-1E is slightly preferred to LF-1E/PI-27E from an overall risk perspective, the remaining two siting options (LF-9C and LF-3C) are compared against LF-1E/PI-27E to determine if they too were preferred to LF-1E/PI-27E. In the LF-9C - LF-1E/PI-27E comparison, LF-1E/PI-27E is favoured for transportation and surface water risk. LF-9C is favoured for hydrogeology and air risk.

Table 6.5 highlights the summary arguments relevant to this comparative evaluation. LF-9C is clearly preferred for the reasons cited below:

TABLE 6.4

Summary Arguments - Risk Rankings - LF-1E versus LF-1E/PI-27E

DISCIPLINE	DISTINCTIONS							REASONS/COMMENTS
	1	2	3	4	5	6	7	
Hydrogeology		0					ND	• options ranked at same level
Transportation		0					ND	• options ranked at same level
Air		0					1E	• LF-1E preferred overall
							1E	• slight differences; closer proximity of PI-27E to the built-up areas of Niagara Falls; reflected in higher existing and future population exposure indices for incinerator stack and fugitive emissions and higher existing and future relative population levels for impact emissions from the incinerator stack
		0	0	0			1E/27E	• LF-1E/PI-27E preferred for upset emissions for low elevation sources; acute sources - low level emissions - greatest uncertainty and least amenable to mitigation
		0	0				1E	• with alternative weighting scheme (where higher weight given to direct air emissions) LF-1E clearly preferred over PI-27E
						0	1E	• air - highly ranked factors (level 9 for direct air emissions)
	0			0			LD	• incremental chronic emission risks acceptable even with very conservative assumptions
	0	0					LD	• acute air emissions risks - have very low probability of occurrence

Legend:

1 - Absolute Risk and Impacts	4 - Uncertainty	7 - Preference
2 - Relative Risk and Impacts	5 - Policy	ND - No Difference
3 - Mitigation	6 - Factor Ranking	LD - Limiting Difference

TABLE 6.4

Summary Arguments - Risk Rankings - LF-1E versus LF-1E/PI-27E

DISCIPLINE	DISTINCTIONS 1	2	3	4	5	6	7	REASONS/COMMENTS
Surface Water		0					1E	• LF-1E preferred - LF-1E/PI-27E is slightly less preferred than LF-1E due to minor flood constraints (GLAL, 1985c, p.121)
			0				ND	• flooding constraint readily mitigable
	0	0					LD	• flooding and water use noted as not being concerns for both options (GLAL, 1985c, p.120)
		0					LD	• limited differences between options reflected in fact that both siting options are placed at the same suitability level - level 1

Legend:

1 - Absolute Risk and Impacts	4 - Uncertainty	7 - Preference
2 - Relative Risk and Impacts	5 - Policy	ND - No Difference
3 - Mitigation	6 - Factor Ranking	LD - Limiting Difference

- The hydrogeologic differences between the two options are major. The strong preference for LF-9C is reflected in suitability level differences - natural containment (-1 versus -5). There are also greater uncertainties with LF-1E/PI-27E than with LF-9C regarding the predictability of geologic conditions and the effectiveness of mitigative measures. This strong preference for LF-9C is tempered somewhat by the recognition that, if the constraints at LF-1E/PI-27E are avoided, comparable breakthrough times can be achieved. However, according to the hydrogeologic consultant, even if the identified constraints of LF-1E/PI-27E are avoided, the residual uncertainties with the Niagara Falls options remain greater at LF-1E/PI-27E than with LF-9C.

- The air differences between the two options are moderate. These differences are reinforced by the low level of absolute risk. However, when the alternative weighting scheme is employed, the gap between the options widens considerably with LF-9C and LF-1E/PI-27E ranked as second and sixth, respectively.

- The surface water differences between the options are minor. The two options are equivalent for flooding potential. The primary difference between the two options is a moderate downstream water use constraint with LF-9C. With LF-1E/PI-27E water use is not a concern. The gap between the two options narrows when ground and surface water factors are considered jointly, because of the greater natural containment afforded by LF-9C. The surface water factor is not ranked as highly as the hydrogeology, air (direct exposure) and transportation factors - a reflection, in part, of the greater mitigation potential associated with the surface water discipline.

- There is a clear transportation preference for LF-1E/PI-27E. The gap between the options is moderate because the statistical difference between the options is not significant. The likelihood of spills and accident involvements across the whole transportation system is also

TABLE 6.5

Summary Arguments - Risk Rankings - LF-1E/PI-27E versus LF-9C

DISCIPLINE	DISTINCTIONS							REASONS/COMMENTS
	1	2	3	4	5	6	7	
Hydrogeology		0					9C	• LF-9C preferred overall
								• LF-9C suitability level - 1.0; LF-1E/PI-27E - suitability level - 5.0; suitability levels 2, 3 and 4 not used because sites either unconstrained or potentially constrained
		0		0			9C	• constraints at LF-1E/PI-27E - confining layer varies because of morainal feature to southeast of LF-1E and buried sand under northwest portion of PI-27E (GLAL, 1985b, p.81)
				0			9C	• sand layers could be present within confining layer under portions of both sites
		0					9C	• LF-9C - uniform predictability of geologic conditions - long breakthrough times - 1200-1700 years
			0	0			9C	• less certainty re. need for and effectiveness of mitigative measures with locally variable conditions
						0	9C	• hydrogeology - one of the highest ranked factors (level 10)
				0			9C	• local variability compounds general uncertainty re. leachate characteristics, ground water flow and contaminant transport and the potential for long-term mitigation
			0	0			9C	• some potential for reducing uncertainty with additional drilling, but even with additional drilling at Niagara Falls sites, residual hydrogeologic risk will remain greater than with LF-9C

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking
7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.5

Summary Arguments - Risk Rankings - LF-1E/PI-27E versus LF-9C

DISCIPLINE	DISTINCTIONS 1	2	3	4	5	6	7	REASONS/COMMENTS
Hydrogeology (continued)		0		0			LD	° if sand layers avoided - long breakthrough times - 750 - 2500 years for LF-1E and 2000 - 2600 years for PI-27E
Transportation		0					1E/27E	° LF-1E/PI-27E - clear preference for LF-1E/PI-27E - based on aggregated value for all factors (-84.0 vs - 137.0)
						0	1E/27E	° local and regional portion of access road system more highly ranked factors (10 vs 8)
						0		° all transportation factors highly ranked (levels 8 or 10)
							1E/27E	° argument that local and regional access road should not be redefined:
		0						- OWMC generated traffic a higher proportion of total traffic with local and regional roads than with freeways
		0						- function of roads less consistent with haulage of special waste
		0						- people and sensitive uses tend to be closer to the road
		0						- lower design standards
		0						- greater level of pedestrian, school bus and agricultural use
					0			- transportation of special wastes to a greater extent on 400 series highways - more consistent with role of roads
		0					1E/27E	° much greater frequency of health threatening spills (all types) on local and regional roads (1 every 20.4 years versus 1 every 277.3 years)

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking
7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.5

Summary Arguments - Risk Rankings - LF-1E/PI-27E versus LF-9C

DISCIPLINE	DISTINCTIONS						7	REASONS/COMMENTS
	1	2	3	4	5	6		
Transportation (continued)		0					1E/27E	• much greater frequency of accident involvements (fatal and injury) on local and regional roads (1 every 7.1 years versus 1 every 1.2 years)
		0					LD	• there are however, considerations which narrow the gap between the options, including:
							9C	- when treated as total transportation system, the frequency of human health threatening special waste spills is greater with LF-1E/PI-27E (1 every 5.4 years) as compared with LF-9C (1 every 6.0 years)
		0					9C	- with respect to fatal and injury accident involvements for total transportation system LF-9C also favoured (2.2 per year versus 2.3 per year)
		0					LD	- argument that local and regional access roads should be redefined - minimizes overall likelihood of events and exposure
		0					ND	- there is no statistical difference between the two options for either total estimated spills and accident involvements or if the comparison is limited to human health threatening special waste spills and fatal and injury accident involvements
		0					9C	- LF-9C is favoured over LF-1E/PI-27E for the province-wide hazard based spill index (1 every 8.5 years versus 1 every 5.5 years) and the province-wide annual accident involvements (1.4 per year versus 2.1 per year)
		0					9C	- with sensitivity analysis (see Chapter 8) defining local and regional access system for Niagara Falls options as the exit point for LF-9C (Regional Road 24) - the clear preference switches to LF-9C

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking
7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.5

Summary Arguments - Risk Rankings - LF-1E/PI-27E versus LF-9C

DISCIPLINE	DISTINCTIONS							REASONS/COMMENTS
	1	2	3	4	5	6	7	
Transportation (continued)			0				LD	• potential to reduce transportation risk in general and especially along local and regional access routes
Air		0					9C	• LF-9C preferred - although differences moderate
		0					9C	• a number of considerations reinforce this preference including:
							9C	- the moderate differences between LF-9C and LF-1E/PI-27E are a reflection of major indirect pathway differences (crops and livestock and, to a lesser extent cisterns and ponds) favouring LF-1E/PI-27E, largely offsetting the chronic and acute direct inhalation emissions pathways which favour LF-9C; the magnitude of this difference is highly dependent on the risk factor weight. In view of order of magnitude differences between direct and indirect pathways (as estimated in the generic risk assessment), arguable that greater weight should be given to the direct pathways. When this was done (see Sensitivity Analyses in Chapter 8), LF-1E/PI-27E is least preferred option and LF-9C is only slightly less preferred than highest ranked option - LF-3C
	0						9C	- direct air pathways at margin of acceptability - one in a million
		0					9C	- for incinerator stack emissions (chronic) LF-1E/PI-27E has much higher suitability levels (-4.5 existing, -3.0 future population) than LF-9C (-1.3 existing and -1.2 future)
		0					9C	- for fugitive emissions is -5.0 (existing and future population) for LF-1E/PI-27E and -1.3 (existing) and -1.2 (future) for LF-9C

Legend:

1 - Absolute Risk and Impacts	4 - Uncertainty	7 - Preference
2 - Relative Risk and Impacts	5 - Policy	ND - No Difference
3 - Mitigation	6 - Factor Ranking	LF - Limiting Difference

TABLE 6.5

Summary Arguments - Risk Rankings - LF-1E/PI-27E versus LF-9C

DISCIPLINE	DISTINCTIONS 1	2	3	4	5	6	7	REASONS/COMMENTS
Air (continued)		0					9C	- for upset emissions - stack - LF-1E/PI-27E - 5.0 (existing and future) and -1.0 (existing) and -1.1 (future) for LF-9C; with upset emissions stack - no adverse health effects expected
			0	0			9C	- mitigation of air risks likely to be easier in long-term in stable area (like LF-9C) than in area with greater growth potential (LF-1E/PI-27E)
		0		0			1E/27E	• pattern reversed for acute low level upset emissions -1.8 (existing) and -1.0 (future) for LF-1E/PI-27E and -2.6 (existing) and -2.2 (future for LF-9C; potential health effects, but very low likelihood of events; more uncertainty with acute events;
	0	0		0			LD	• incremental chronic emission risks acceptable even with very conservative assumptions
	0	0					LD	• limited differences - overall ORF ratings - -2.3 (LF-9C) and -2.5 (LF-1E/PI-27E)
Surface Water		0					1E/27E	• LF-1E/PI-27E preferred overall - moderate constraints - potential for water use interference; -3 rating for LF-9C versus -1 for LF-1E/PI-27E
		0	0				LF-9C	• surface water suitability - minor flooding potential - difference - suitability level -1 for LF-9C and -2 for LF-1E/PI-27E; flooding constraints at LF-1E/PI-27E minor and mitigable
							LD	• surface water use differences not major for the following reasons:

Legend:

1 - Absolute Risk and Impacts	4 - Uncertainty	7 - Preference
2 - Relative Risk and Impacts	5 - Policy	ND - No Difference
3 - Mitigation	6 - Factor Ranking	LD - Limiting Difference

TABLE 6.5

Summary Arguments - Risk Rankings - LF-1E/PI-27E versus LF-9C

DISCIPLINE	DISTINCTIONS 1	2	3	4	5	6	7	REASONS/COMMENTS
Surface Water (continued)		0					ND	- severe surface water risks addressed during previous site selection stages; constraints considered mitigable - contaminants would be retained on-site through design and operations
		0					LD	- no major sensitive uses such as a municipal water intake (existing or planned) downstream of the candidate site
			0				LD	- in unlikely event of surface water release, the monitoring of water quality, the notification of owners, dilution and alternative water supplies could assist in avoiding potential human health effects
						0	LD	- surface water factor rankings - intermediate (level 7)
		0					LD	- difference between options narrows when surface and ground water use are considered jointly; greater natural containment (LF-9C) limited ground/surface water connections

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation

4 - Uncertainty
5 - Policy
6 - Factor Ranking

7 - Preference
ND - No Difference
LD - Limiting Difference

greater with LF-9C. However, the sensitivity analysis, which redefined the local and regional access system, resulted in a clear preference for LF-9C. As indicated in Table 6.5, there are also arguments in favour of not changing the definition of local and regional access roads.

On the basis of the above, the choice between LF-1E/PI-27E and LF-9C is essentially a tradeoff between a minor surface water difference (moderately ranked factors) and a moderate transportation risk difference (highly ranked factors) favouring LF-1E/PI-27E as against a moderate air risk difference and a major hydrogeologic risk difference favouring LF-9C. On balance, the air and hydrogeologic risk differences favouring LF-9C more than offset the surface water and transportation risk differences favouring LF-1E/PI-27E.

(d) LF-1E/PI-27E versus LF-3C

To this point in the comparison of the four preferred options, LF-9C and LF-1E have both been ranked more highly than LF-1E/PI-27E. In this step, the remaining siting option, LF-3C, is compared to LF-1E/PI-27E to determine if it too is favoured over LF-1E/PI-27E. In this comparison, transportation and surface water risks favour LF-1E/PI-27E. Hydrogeology and air risks favour LF-3C. Table 6.6 highlights the summary arguments relevant to this comparative evaluation. The differences between the two options are quite limited. The two options have been ranked at the same level for the following reasons:

- The hydrogeologic differences between the two options are major. The strong preference for LF-3C is reflected in the factor suitability level differences for natural containment and ground water use (level-1 versus level 5 for both factors). It is also exemplified by the predictability of geologic conditions and the effectiveness of mitigative measures uncertainties with LF-1E/PI-27E. The strength of the hydrogeologic preference for LF-3C is tempered somewhat by the potential of achieving long breakthrough times by avoiding the local

TABLE 6.6

Summary Arguments - Risk Rankings - LF-1E/PI-27E versus LF-3C

DISCIPLINE	CRITERIA 1	2	3	4	5	6	7	REASONS/COMMENTS
Hydrogeology		0					3C	° LF-3C preferred overall
							3C	° LF-3C - suitability level natural containment - -1.0; LF-1E/PI-27E suitability level -5.0; suitability levels 2, 3 and 4 not used because sites either unconstrained or potentially constrained
		0		0			3C	° constraints at LF-1E/PI-27E - confining layer varies because of morainal feature to southeast of LF-1E and buried sand underlying the northwest portion of PI-27E (GLAL, 1985b, p.81)
				0			3C	° sand layers could be present within confining layer of both sites
		0					3C	° LF-3C - uniform predictability of geologic conditions - long breakthrough times - 600 to 1900 years
		0					3C	° LF-3C - ground water use is - -1.0; LF-1E/PI-27E is -5.0
						0	3C	° hydrogeology - one of the highest ranked factors (level 10)
				0			3C	° local variability compounds general uncertainty re. leachate characteristics, ground water flow and contaminant transport and the potential for long-term mitigation
			0	0			LD	° some potential for reducing uncertainty with additional drilling; even with additional drilling at Niagara Falls sites, residual hydrogeologic risk greater with LF-1E/PI-27E

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking
7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.6

Summary Arguments - Risk Rankings - LF-1E/PI-27E versus LF-3C

DISCIPLINE	CRITERIA 1	2	3	4	5	6	7	REASONS/COMMENTS
Hydrogeology (continued)		0		0			LD	• if sand layers avoided - long breakthrough times - 750 to 2500 years for LF-1E and 2000 to 2600 years for PI-27E
Transportation		0					1E/27E	• LF-1E/PI-27E preferred overall
		0					1E/27E	• LF-1E/PI-27E - clear preference for LF-1E/PI-27E based on aggregated value for all factors (-84.0 versus -152.0)
	0						1E/27E	• total spill frequency - LF-1E/PI-27E slightly favoured (one every 5.4 years versus one every 5.1 years)
	0						1E/27E	• total accident frequency - LF-1E/PI-27E slightly favoured (2.6 accidents per year versus 2.3 accidents per year)
	0						1E/27E	• much greater frequency of human health threatening spills (all types) on local and regional roads for LF-3C (one every 13.0 years versus one every 277.3 years)
	0						1E/27E	• greater frequency of accident involvements (fatal and injury) on local and regional roads for LF-3C (one every 0.8 years versus one every 7.1 years)
						0	1E/27E	• local and regional portion of access road system more highly ranked factors (10 versus 8)
						0	1E/27E	• all transportation factors - highly ranked (levels 8 or 10)

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking
7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.6

Summary Arguments - Risk Rankings - LF-1E/PI-27E versus LF-3C

DISCIPLINE	CRITERIA 1	2	3	4	5	6	7	REASONS/COMMENTS
Transportation (continued)		0					1E/27E	° argument that local and regional access road system should not be redefined to include that portion of the QEW between Regional Road 24 and Regional Road 47: - OWMC generated traffic a higher proportion of total traffic - function of roads less consistent with haulage of special waste - people and sensitive uses tend to be closer - lower design standards - greater level of pedestrian, school bus and agricultural use
					0		1E/27E	° transportation of special wastes, to a greater extent on 400 series highways, more consistent with role of roads
								° there are a number of tempering considerations:
		0					ND	- there is no statistical difference between the two options for either total estimated spills or accident involvements or if the comparison is limited to human health threatening special waste spills and fatal and injury accident involvements
		0					3C	- LF-3C is favoured over LF-1E/PI-27E for the province-wide hazard based spill index (one every 8.5 years versus one every 5.5 years) and the province-wide annual accident involvements (1.4 per year versus 2.1 per year)
		0					3C	- when sensitivity analysis undertaken (see Chapter 8), which defines local and regional access system for Niagara Falls options as the exit point for LF-3C (Regional Road 24) - the ranking of the options is reversed

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking
7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.6

Summary Arguments - Risk Rankings - LF-1E/PI-27E versus LF-3C

	CRITERIA							
DISCIPLINE	1	2	3	4	5	6	7	REASONS/COMMENTS
Transportation (continued)		0					LD	- argument that local and regional access roads should be redefined - minimizes overall likelihood of events and exposure
Air		0					3C	• LF-3C preferred overall - although difference moderate
							3C	• a number of considerations reinforce this preference including:
		0					3C	- moderate differences between LF-3C and LF-1E/PI-27E is a reflection of indirect air factors (cisterns and ponds and crops and livestock) partially offsetting gap based on direct chronic and acute emissions risks; the magnitude of this difference is highly dependent on the risk factor weight. In view of order of magnitude differences between direct and indirect pathways (as estimated in the generic risk assessment), arguable that greater weight should be given to the direct emissions. When this is done (see Sensitivity Analyses in Chapter 8) LF-1E/PI-27E is least preferred and LF-3C is most preferred
	0	0					3C	- arguable that direct air factors at margin of acceptability - risk of additional cancer is one in a million
		0					3C	• for incinerator stack emissions (chronic) - LF-1E/PI-27E has much higher factor suitability levels (-4.5 existing, -3.0 future population) than LF-3C (-1.0 existing and future)
		0					3C	• for fugitive emissions (chronic) is -5.0 (existing and future) for LF-1E/PI-27E and -1.0 (existing and future) for LF-3C

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation

4 - Uncertainty
5 - Policy
6 - Factor Ranking

7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.6

Summary Arguments - Risk Rankings - LF-1E/PI-27E versus LF-3C

DISCIPLINE	CRITERIA							REASONS/COMMENTS
	1	2	3	4	5	6	7	
Air (continued)		0					3C	° for upset emissions (stack) are -5.0 (existing and future population) for LF-1E/PI-27E and -1.0 (existing) and -1.0 (future) for LF-3C
		0					1E/27E	° pattern reversed for low level upset emissions - PI-27E is -1.8 (existing) and -1.0 (future); LF-3C is -2.4 (existing) and -2.1 (future)
		0					LD	° low likelihood of events; more uncertainty with acute events emissions
		0					LD	° incremental chronic emission risks acceptable even with very conservative assumptions
							LD	° limited differences - overall factor suitability levels are -2.2 (LF-3C) and -2.5 (LF-1E/PI-27E)
Surface Water		0					1E/27E	° LF-1E/PI-27E preferred overall
		0					1E/27E	° LF-3C has major constraints due to flood susceptibility as a result of the proximity of the Beaver Creek and Welland River floodplains
		0					1E/27E	° susceptibility of site to flooding-relative factor suitability ratings are -5.0 for LF-3C and -2.0 for LF-1E/PI-27E
			0	0			1E/27E	° although flooding constraints of LF-3C mitigable, flooding potential uncertainty and greater reliance on engineering
			0				LD	° flooding constraints at LF-3C mitigable

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
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4 - Uncertainty
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6 - Factor Ranking

7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.6

Summary Arguments - Risk Rankings - LF-1E/PI-27E versus LF-3C

DISCIPLINE	CRITERIA							REASONS/COMMENTS
	1	2	3	4	5	6	7	
Surface Water (continued)							LD	° potential for surface water use interference greater with LF-3C (factor suitability levels -3.0 for LF-3C versus -1.0 for LF-1E/PI-27E)
		0					3C	° overall rating LF-3C (-4.0) and LF-1E/PI-27E (-1.0)
						0	LD	° surface water use interference higher ranked factor than flood potential factor
		0					LD	° differences between options narrowed when surface and ground water uses are considered jointly - with greater natural containment (LF-3C), limited ground/surface water connections
		0					LD	° severe surface water risks addressed during previous site selection stages; constraints considered mitigable - contaminants retained on-site through design and operations
		0					LD	° no major sensitive uses such as a municipal water intake (existing or planned) downstream of the candidate sites
			0				LD	° in unlikely event of surface water releases, the monitoring of water quality, the notification of owners, dilution and alternative water supplies assist in avoiding potential human health effects
						0	LD	° surface water factor rankings - intermediate to low

Legend:

1 - Absolute Risk and Impacts
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7 - Preference
ND - No Difference
LD - Limiting Difference

constraints in the vicinity of the Niagara Falls sites. The predictability of conditions and mitigation potential uncertainties would, however, remain greater with the Niagara Falls options even if the local constraint is avoided.

- The air differences between the two options are moderate and favour LF-3C. These differences are more than moderate when the alternative weighting scheme is applied. When additional weight is given to the direct air factors, the options are ranked first and sixth, with a wide gap based on suitability levels.

- There is a strong transportation preference for LF-1E/PI-27E over LF-3C. This difference reflects the longer regional and local access system to LF-3C and the greater weight attached to the local and regional component of the transportation system. The preference for LF-1E/PI-27E is based on total spill and accident frequencies, both of which slightly favour LF-1E/PI-27E.

  As indicated in Table 6.6, there are arguments which moderate the preference for LF-1E/PI-27E. The likelihood of spills and accident involvements across the whole transportation system is greater with LF-3C. However, the sensivity analysis which redefines the local and regional access system, resulted in a clear preference for LF-3C. As indicated in Table 6.6, there are arguments in favour of not redefining the local and regional access roads. The strength of transportation risk differences favouring LF-1E/PI-27E between the two options are also moderated by the lack of a statistical difference in spills or accidents between the two options. Thus, although the transportation risk considerations generally favour LF-1E/PI-27E, the differences are moderate.

- The surface water discipline strongly favours LF-1E/PI-27E. With LF-3C there is a major, although mitigable, flooding constraint. Although the constraint of LF-3C is mitigable, as Table 6.6 points out, there is greater flooding potential uncertainty and a greater reliance on engineering. The strong flooding potential preference for LF-1E/PI-27E is reinforced by the greater potential for surface water use interference with LF-3C. This difference is ameliorated somewhat by the greater natural containment offered at LF-3C. With greater natural containment, the potential for ground/surface water connections is reduced.

In summary, the choice between LF-1E/PI-27E and LF-3C is a tradeoff between a major surface water difference and a moderate transportation difference favouring LF-1E/PI-27E and a major hydrogeology difference and a moderate air difference favouring LF-3C. It can be argued that the lower ranking for the surface water factor shifts the balance slightly in favour of LF-3C. However, because the tradeoffs so closely balance one another, it is difficult to identify a clear preference. LF-3C and LF-1E/PI-27E are, therefore, ranked at the same level.

(e) LF-3C versus LF-9C

The analysis to this point resulted in the following conclusions, from a risk perspective:

- LF-4N/PI-13N is clearly the least preferred option;
- LF-4N/PI-1N is the next least preferred option;
- of the remaining four options, LF-1E is slightly favoured over LF-1E/PI-27E. LF-9C is moderately favoured over LF-1E/PI-27E. LF-3C is ranked as the same level as LF-1E/PI-27E.

LF-1E and LF-9C are favoured over LF-1E/PI-27E. LF-3C is ranked at the same level as LF-1E/PI-27E. It is, therefore, likely that LF-1E and LF-9C will also be favoured over LF-3C. LF-9C and LF-1E are, therefore, next compared to LF-3C to determine if such is the case.

Transportation risks and surface water favour LF-9C over LF-3C. Hydrogeology favours LF-3C. The summary arguments relevant to this comparison are presented in Table 6.7. LF-9C is moderately preferred for the following reasons:

- The hydrogeologic differences between the options are moderate. Both sites possess uniform geologic predictability. The primary difference between the two sites is the limited potential for expansion of the use of the aquifer LF-3C. As indicated in Table 6.7, ground water use is of secondary importance to natural containment because:

  - all site vicinities involve ground water use;
  - any use of ground water is a concern if no or inadequate natural containment is provided;
  - ground water use varies somewhat among sites, but is difficult to determine precisely;
  - ground water use is difficult to control and can change over time.

  On the basis of the above, the moderate hydrogeologic differences favouring LF-3C do not offset the transportation and surface water advantages possessed by LF-9C.

- The differences between the two sites for the air risk discipline are minor. LF-3C and LF-9C have -2.2 and -2.3 weighted factor suitability levels, respectively. The two options are ranked one and two, respectively, for overall air risk. This order of preference does not change when the alternative logarithmic weighting scheme is applied. The differences between the two options are a consequence of a minor direct acute and chronic emissions difference favouring LF-3C being partially offset by a greater weighted factor suitability level for the cistern and pond water factor. As with the hydrogeologic factors, it is a case of two highly ranked options with relatively minor differences.

TABLE 6.7

Summary Arguments - Risk Rankings - LF-3C versus LF-9C

	DISTINCTIONS							
DISCIPLINE	1	2	3	4	5	6	7	REASONS/COMMENTS
Hydrogeology		0					3C	° the primary difference between the two options is the better quality aquifer underlying LF-9C. In the case of LF-3C, existing ground water use and potential demand is limited. In the case of LF-9C, existing ground water use and potential demand has expansion potential
		0					3C	° factor suitability level for ground water use -1.0 for LF-3C and -5.0 for LF-9C
		0					ND	° both siting options have a -1.0 factor suitability level for natural containment suitability. In both cases, predictability of geologic conditions is uniform and containment breakthrough times are long
		0					ND	° in both instances, alternative ground water supplies are available
		0					LD	° LF-3C and LF-9C are the preferred and the second most preferred siting options, respectively
						0	LD	° natural containment factor ranked more highly than impact on ground water use factor
		0				0	LD	° the major reasons why ground water use is of secondary importance include the following: - all the site vicinities involve some use of ground water - effects potentially severe if contaminants released into ground water over prolonged period - any use of ground water is a concern if no or inadequate natural containment is provided

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking
7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.7

Summary Arguments - Risk Rankings - LF-3C versus LF-9C

DISCIPLINE	DISTINCTIONS							REASONS/COMMENTS
	1	2	3	4	5	6	7	
Hydrogeology (continued)								- ground water use varies somewhat among siting options, but is difficult to determine precisely - ground water is difficult to control and can change over time
Transportation		0					9C	• LF-9C preferred overall
		0					9C	• LF-9C and LF-3C ranked fifth and sixth, respectively; aggregated value for all factors (-137.0 versus -152.0)
		0					9C	• moderate difference in spills (all types) on local and regional roads (one every 13.0 years versus one every 20.4 years)
		0					9C	• moderate difference in health-threatening accident involvements on local and regional roads (one every 0.8 years versus one every 1.2 years)
		0					9C	• also moderate difference in spills (all types) on total transport system (one every 5.1 years versus one every 6.0 years)
		0					9C	• also moderate difference in a human health-threatening accident involvements on total transport system (2.6 per year versus 2.2 per year)
						0	9C	• greater factor weight attached to local and regional access roads (10 versus 8)
		0					ND	• there is no statistical difference between the two options for the province-wide transport system

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking
7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.7

Summary Arguments - Risk Rankings - LF-3C versus LF-9C

DISCIPLINE	DISTINCTIONS							REASONS/COMMENTS
	1	2	3	4	5	6	7	
Transportation (continued)		0					ND	° no difference between options for all types of human health-threatening spills and accident involvements for province-wide access system
Air		0					3C	° LF-3C slightly preferred overall - options ranked one and two, respectively, for overall air risk
		0					3C	° LF-3C and LF-9C received overall option scores of -2.2 and -2.3, respectively
		0					3C	° the difference between the two options is a consequence of a minor direct acute and chronic emissions difference favouring LF-3C partially offset by a greater difference for the cistern and pond water factor favouring LF-9C
		0					LD	° differences between options minor overall and for direct chronic and acute emissions
		0					LD	° order of preference does not change when the alternative weighting scheme (which weights direct emissions more highly) is applied. The options also remain equally close together
Surface Water								° LF-9C overall preference
		0					9C	° LF-9C and LF-3C have flooding potential suitability levels of -1.0 and -5.0, respectively
		0	0				9C	° LF-9C has minor, readily mitigable constraints

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation

4 - Uncertainty
5 - Policy
6 - Factor Ranking

7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.7

Summary Arguments - Risk Rankings - LF-3C versus LF-9C

DISCIPLINE	DISTINCTIONS							REASONS/COMMENTS
	1	2	3	4	5	6	7	
Surface Water (continued)		0					9C	° LF-3C has major flood susceptibility constraints because of the proximity of the Beaver Creek and Welland River floodplains
		0	0	0			9C	° although flooding constraints considered mitigable, greater flooding potential uncertainty and greater reliance on engineering with LF-3C
		0					9C	° overall factor suitability levels for LF-3C and LF-9C - -4.0 and -3.0, respectively
		0					ND	° potential for surface water use interference same for both options
			0				LD	° flooding constraints at LF-3C mitigable
		0	0				LD	° severe surface water risks addressed during previous site selection stages; constraints considered mitigable; contaminants retained on site through design and operations
			0				LD	° in unlikely event of surface water release, the monitoring of water quality, the notification of owners, dilution and alternative water supplies assist in avoiding potential human health effects
		0					LD	° with good natural containment - potential for ground/surface water connections limited
						0	LD	° surface water factors ranked at levels 7 and 3 - lower than transportation, hydrogeology and direct air risk factors

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking
7 - Preference
ND - No Difference
LD - Limiting Difference

- LF-9C and LF-3C are ranked fifth and sixth, respectively, for potential transportation risk. The gap between LF-9C and LF-3C is sufficient to result in clear differences in spill and accident factor suitability levels for the local and regional access roads, and in the frequency of spills and accidents along the local and regional access roads. There are also minor differences in spill and accident involvement frequencies along the total transport system. These differences are not statistically significant. On balance, the transportation risk differences between the two options are at least minor and potentially moderate.

- There is a minor surface water suitability preference for LF-9C. Both options have moderate water use ratings, but LF-3C has a major, although mitigable, flooding constraint. With LF-3C, there is greater flooding potential uncertainty and a greater reliance on engineering.

The final choice between the two options is a tradeoff between moderate surface water and transportation risk differences favouring LF-9C and minor air and hydrogeologic risk differences favouring LF-3C. Both West Lincoln options have high air and hydrogeologic rankings and low transportation risk rankings. The ranking of LF-9C over LF-3C represents a significant opportunity for reducing potential transportation and surface water risk while, at the same time, maintaining a high degree of hydrogeologic and air risk suitability.

(f) LF-1E versus LF-3C

In the previous step, LF-9C was moderately preferred to LF-3C. In this step, LF-1E is compared to LF-3C to determine if it too is preferred to LF-3C.

Transportation and surface water risks favour LF-1E. Hydrogeologic and air risks favour LF-9C. The summary arguments relevant to this comparison are presented in Table 6.8. LF-1E is preferred for the following reasons:

- The hydrogeologic differences between the two options are major. The strong preference for LF-3C is reflected in the factor suitability level differences for natural containment and ground water use (-1.0 versus -5.0). It is also reflected in the predictability of geologic conditions and effectiveness of mitigative measures uncertainties with LF-1E. The strong preference for LF-3C is tempered somewhat by the potential of long breakthrough times if the local constraints are avoided at LF-1E. The uncertainties regarding predictability of geologic conditions and the effectiveness of mitigative measures remain with LF-1E even if the constraints are avoided.

- The air differences between the two options are minor to potentially moderate. The two options are ranked first and second for air risk. There are only slight ORF suitability level differences between LF-1E and LF-3C. A more clear-cut gap emerges favouring LF-3C when the alternative weighting scheme is employed.

- There is a strong transportation preference for LF-1E over LF-3C. This difference stems from the long local and regional access route to LF-3C and the higher ranking given to the local and regional component of the transportation system. Total accident frequencies favour LF-1E, as does the policy argument that the function of 400-series is more consistent with the haulage of special waste. The argument in favour of LF-1E is, however, ameliorated somewhat by the lack of a statistical difference in accident and spill frequencies. In addition, if the alternative definition of the local and regional road system is used, the preference shifts to LF-3C. On the basis of the above, the transportation preference for LF-1E is moderate.

- The surface water risks strongly favour LF-1E over LF-3C. Although the major flooding constraint at LF-3C is mitigable, there remains a greater flooding potential uncertainty and a greater reliance on engineering. The flooding potential preference for LF-1E is reinforced by the greater potential for surface water use interference with LF-3C.

TABLE 6.8

Summary Arguments - Risk Rankings - LF-1E versus LF-3C

DISCIPLINE	DISTINCTIONS							REASONS/COMMENTS
	1	2	3	4	5	6	7	
Hydrogeology		0					3C	° LF-3C preferred overall
								° LF-3C suitability level - natural containment -1.0; LF-1E suitability level -5.0; suitability levels 2, 3 and 4 not used because sites either relatively unconstrained or potentially constrained
		0					3C	° constraints at LF-1E - confining layer varies because of morainal feature to southeast of LF-1E
		0					3C	° sand layers could be present within confining layer of LF-1E
		0					3C	° LF-3C uniform predictability of geologic conditions - long breakthrough times 600 to 1900 years
		0					3C	° LF-3C - ground water use -1.0; for LF-1E it is -5.0
						0	3C	° hydrogeology - one of the highest ranked factors (level 10)
				0			3C	° local variability compounds general uncertainty re. leachate characteristics, ground water flow and contaminant transport and the potential for long-term mitigation
		0		0			LD	° if sand layers avoided - long breakthrough times - 750 to 2500 years
			0	0			LD	° some potential for reducing uncertainty with additional drilling; but even with additional drilling at Niagara Falls site, residual hydrogeologic risk greater with LF-1E

Legend:

1 - Absolute Risk and Impacts	4 - Uncertainty	7 - Preference
2 - Relative Risk and Impacts	5 - Policy	ND - No Difference
3 - Mitigation	6 - Factor Ranking	LD - Limiting Difference

TABLE 6.8

Summary Arguments - Risk Rankings - LF-1E versus LF-3C

DISCIPLINE	DISTINCTIONS 1	2	3	4	5	6	7	REASONS/COMMENTS
Transportation		0					1E	° LF-1E preferred overall
							1E	° LF-1E - clear preference for LF-1E based on aggregated value for all factors (-84.0 versus -152.0)
		0					1E	° total accident frequency - LF-1E slightly favoured (2.3 accidents per year versus 2.6 accidents per year)
		0					1E	° greater frequency of human health threatening spills (all types) on local and regional roads (one every 90.3 years versus one every 13.0 years)
		0					1E	° greater frequency of accident involvements (fatal and injury) on local and regional roads (one every 5.4 years versus one every 0.8 years)
						0	1E	° local and regional portion of access road system more highly ranked factors (10 versus 8)
						0	1E	° all transportation factors highly ranked (levels 8 or 10)
		0					1E	° argument that local and regional access road system should not be redefined to include that portion of the QEW between Regional Road 24 and Regional Road 47: - OWMC generated traffic a higher proportion of total traffic - function of roads less consistent with haulage of special waste - people and sensitive uses tend to be closer - lower design standards

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
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4 - Uncertainty
5 - Policy
6 - Factor Ranking
7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.8

Summary Arguments - Risk Rankings - LF-1E versus LF-3C

DISCIPLINE	DISTINCTIONS						7	REASONS/COMMENTS
	1	2	3	4	5	6		
Transportation (continued)								- greater level of pedestrian, school bus and agriculture use
					0		1E	• transportation of special wastes to a greater extent on 400 series highways - more consistent with role of roads
		0					ND	• no difference in total spill frequency (one every 5.1 years)
		0					ND	• there are no total estimated spills or accident involvements statistical differences between the two options or if the comparison is limited to human health threatening special waste spills and fatal and injury accident involvements
		0					3C	• LF-3C is favoured over LF-1E for the province-wide hazard based spill index (one every 8.5 years versus one every 5.5 years) and the province-wide annual accident involvements (1.4 per year versus 2.1 per year)
		0					3C	• when sensitivity analysis undertaken (see Chapter 8), which defines local and regional access system for Niagara Falls option as the exit point for LF-3C - ranking of the options is reversed
		0					LD	• argument that local and regional access roads should be redefined - minimizes overall likelihood of events and exposure
Air		0					3C	• LF-3C preferred overall

Legend:

1 - Absolute Risk and Impacts	4 - Uncertainty	7 - Preference
2 - Relative Risk and Impacts	5 - Policy	ND - No Difference
3 - Mitigation	6 - Factor Ranking	LD - Limiting Difference

TABLE 6.8

Summary Arguments - Risk Rankings - LF-1E versus LF-3C

DISCIPLINE	DISTINCTIONS						7	REASONS/COMMENTS
	1	2	3	4	5	6		
Air (continued)								° options ranked one and two, respectively, for all air risk
		0					LD	° LF-3C and LF-1E received -2.2 and -2.3 overall ORF option scores, respectively
		0					3C	° the differences between the two options are a consequence of the direct emissions (chronic and acute) and risks from the ingestion of cistern and pond water being largely offset by a major difference favouring LF-1E for risks from the consumption of crops and livestock
		0					3C	° a number of considerations reinforce this slight preference including: - slight differences between options a consequence of indirect pathways closing gap based on chronic and acute direct emissions; the magnitude of this difference is highly dependent on the risk factor weight. In view of order of magnitude differences between direct and indirect factors (as estimated in the generic risk assessment), arguable that greater weight should be given to the direct factors. When this is done, a more distinct preference for LF-3C is evident
	0	0					3C	° arguable that direct air factors at margin of acceptability - risk of additional cancer is one in a million
		0					3C	° for chronic incinerator stack emissions: - LF-3C -1.0 (existing) -1.0 (future) - LF-1E -3.8 (existing) -2.6 (future)

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
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ND - No Difference
LD - Limiting Difference

TABLE 6.8

Summary Arguments - Risk Rankings - LF-1E versus LF-3C

DISCIPLINE	DISTINCTIONS							REASONS/COMMENTS
	1	2	3	4	5	6	7	
Air (continued)								° for chronic fugitive emissions: - LF-3C -1.0 (existing) -1.0 (future) - LF-1E -1.9 (existing) -1.2 (future)
		0					3C	° for acute incinerator stack emissions: - LF-3C -1.0 (existing) -1.0 (future) - LF-1E -1.4 (existing) -1.6 (future)
		0					3C	° for acute low level emissions: - LF-3C -2.4 (existing) -2.1 (future) - LF-1E -4.5 (existing) -3.4 (future)
		0					LD	° differences between options very minor overall
		0					LD	° options ranked first and second overall
	0	0		0			LD	° incremental chronic emissions risks acceptable even with very conservative assumptions
Surface Water		0					1E	° LF-1E preferred overall
		0					1E	° LF-3C has major flood susceptibility constraint as a result of the proximity of the site to the Beaver Creek and Welland River floodplains
		0					1E	° susceptibility of site to flooding - relative factor suitability levels -5.0 for LF-3C and -1.0 for LF-1E
			0	0			1E	° although flooding constraints at LF-3C considered mitigable, greater flooding potential uncertainty and greater reliance on engineering with LF-3C

Legend:

1 - Absolute Risk and Impacts	4 - Uncertainty	7 - Preference
2 - Relative Risk and Impacts	5 - Policy	ND - No Difference
3 - Mitigation	6 - Factor Ranking	LD - Limiting Difference

TABLE 6.8

Summary Arguments - Risk Rankings - LF-1E versus LF-3C

DISCIPLINE	DISTINCTIONS 1	2	3	4	5	6	7	REASONS/COMMENTS
Surface Water (continued)		0					1E	° overall suitability level -1.0 for LF-1E and -4.0 for LF-3C
			0				LD	° flooding constraints at LF-3C mitigable
		0					LD	° potential for surface water use interference greater with LF-3C (factor suitability levels -3.0 for LF-3C versus -1.0 for LF-1E)
						0	LD	° surface water use interference - higher ranked factor
		0					LD	° differences between options narrowed when surface and ground water use are considered jointly with greater natural containment (LF-3C) - limited ground/surface water connections
		0					LD	° severe surface water risks addressed during previous site selection stages; constraints considered mitigable - contaminants retained on-site through design and operations
		0					LD	° no major sensitive uses such as a municipal water intake (existing or planned) downstream of the candidate sites
		0					LD	° in unlikely event of surface water releases, the monitoring of water quality, the notifications of owners, dilution and alternative water supplies assist in avoiding potential human health effects
						0	LD	° surface water factor rankings - intermediate to low

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking
7 - Preference
ND - No Difference
LD - Limiting Difference

This difference is ameliorated somewhat by the greater natural containment offered at LF-3C and by the potential for mitigating surface water risks.

The major risk tradeoffs between LF-1E and LF-3C are between the strong surface water, and to a lesser extent, transportation risk preference for LF-1E, and a strong hydrogeologic preference together with a slight air risk preference for LF-3C. With the surface and ground water factors, there are countervailing areas of uncertainty, i.e. the moraine and sand layers adjacent to LF-1E and the flooding potential and reliance on engineering uncertainties for LF-3C.

The surface water suitability gap between LF-3C and LF-1E is wide. The hydrogeologic suitability gap between LF-3C and LF-1E is also wide. The natural containment factor is ranked much higher than the flooding potential factor (level 10 versus level 3).

The strong hydrogeologic and slight air preference for LF-3C is partially, though not completely, offset by the strong surface water preference for LF-1E. The strong transportation risk preference for LF-1E shifts the balance in favour of LF-1E. The higher transportation factor rankings (as compared with air factors) reinforce this preference. On the basis of the above, LF-1E is slightly preferred over LF-3C. The differences between the two options are, however, limited.

(g) LF-1E versus LF-9C

On the basis of the preceding analyses:

- LF-4N/PI-13N is the least preferred option;
- LF-4N/PI-1N is the second least preferred option;
- LF-1E and LF-9C are preferred over LF-1E/PI-27E (slight and moderate differences, respectively);
- LF-3C and LF-1E/PI-27E are ranked at the same level;

- LF-1E and LF-9C are preferred over LF-3C (slight and moderate differences, respectively).

What remains to be established is a preference between LF-1E and LF-9C.

The choice between LF-1E and LF-9C involves some difficult tradeoffs. LF-9C is preferred over LF-1E for hydrogeologic risk. LF-1E is preferred over LF-9C for transportation and surface water risks. The two options are ranked at the same level for air risks. However, with the alternative weighting scheme, LF-9C is preferred. The summary arguments relevant to this comparison are highlighted in Table 6.9. LF-9C is preferred over LF-1E for the following reasons:

- The hydrogeologic differences between the two options are major. The strong preference for LF-9C is reflected in the factor suitability level differences for natural containment (-1.0 versus -5.0). It is also illustrated by the predictability of geologic conditions and effectiveness of mitigative measures uncertainties associated with LF-1E. The strength of this preference is tempered by the potential for avoiding the constraints at LF-1E and of achieving long breakthrough times.

- The two options received equivalent factor suitability levels for air risks. A moderate difference between the two options, favouring LF-9C, does, however, emerge when the alternative weighting scheme is employed.

- The transportation risk differences favour LF-1E over LF-9C. However, the gap between the options is tempered somewhat by the lack of a statistically significant difference between the two options, the likelihood of spills and accident involvements across the whole transportation system favouring LF-9C and the sensitivity analysis (which redefined the local and regional access system) which clearly

TABLE 6.9

Summary Arguments - Risk Rankings - LF-1E versus LF-9C

DISCIPLINE	DISTINCTIONS							REASONS/COMMENTS
	1	2	3	4	5	6	7	
Hydrogeology		0					9C	° LF-9C preferred overall
		0						° LF-9C suitability level - 1.0; LF-1E suitability level - 5.0; suitability levels 2, 3 and 4 not used because sites either unconstrained or potentially constrained
		0					9C	° constraints at LF-1E; confining layer varies because of morainal feature to southeast of LF-1E
		0					9C	° sand layers could be present within confining layer at LF-1E
		0					9C	° LF-9C uniform predictability of geologic conditions - long breakthrough times - 1200 to 1700 years
		0	0	0			9C	° less certainty re. need for and effectiveness of mitigative measures with locally variable conditions
						0	9C	° hydrogeology - one of the highest ranked factors (level 10)
			0	0			9C	° local variability compounds general uncertainty re. leachate characteristics, ground water flow and contaminant transport and the potential for long-term mitigation
			0	0			9C	° some potential for reducing uncertainty with additional drilling at Niagara Falls sites, residual hydrogeologic risk remains greater with LF-9C
		0					LD	° if sand layers avoided - long breakthrough times - 750 to 2500 years for LF-1E

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking
7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.9

Summary Arguments - Risk Rankings - LF-1E versus LF-9C

DISCIPLINE	DISTINCTIONS 1	2	3	4	5	6	7	REASONS/COMMENTS
Transportation		0					1E	° LF-1E - clear preference for LF-1E; based on aggregated value for all factors (-84.0 versus -137.0)
						0	1E	° local and regional portion of access road system more highly ranked factors (10 versus 8)
						0	1E	° all transportation factors highly ranked (level 8 or 10)
		0					1E	° argument that local and regional access road should not be redefined to include that portion of the QEW between Regional Road 24 and Regional Road 47:
		0						- OWMC generated traffic a higher proportion of total traffic
		0						- function of roads less consistent with haulage of general waste
		0						- people and sensitive uses tend to be closer to the road
		0						- lower design standards
		0						- greater level of pedestrian, school bus and agricultural use
					0		1E	° transportation of special wastes to a greater extent on 400-series highways more consistent with role of roads
		0					1E	° much greater frequency of health threatening spills (all types) on local and regional roads (one every 90.3 years versus one every 20.4 years)

Legend:

1 - Absolute Risk and Impacts	4 - Uncertainty	7 - Preference
2 - Relative Risk and Impacts	5 - Policy	ND - No Difference
3 - Mitigation	6 - Factor Ranking	LD - Limiting Difference

TABLE 6.9

Summary Arguments - Risk Rankings - LF-1E versus LF-9C

DISCIPLINE	DISTINCTIONS 1	 2	 3	 4	 5	 6	7	REASONS/COMMENTS
Transportation (continued)		0					1E	° much greater frequency of accident involvements (fatal and injury) on local and regional roads (one every 5.4 years versus one every 1.2 years)
		0					LD	° argument that local and regional access roads should be redefined - minimizes overall likelihood of events and exposure
								° there are, however, a number of tempering considerations, including:
		0					9C	- when treated as a total transportation system, the frequency of human health threatening special waste spills is greater with LF-1E (one every 5.1 years) as compared with LF-9C (one every 6.0 years)
		0					9C	- the same pattern exists for fatal and injury accident involvements (2.3 per year versus 2.2 per year)
		0					ND	- there is no statistical difference between the two options for either total estimated spills and accident involvements, or if the comparison is limited to human health threatening special waste spills and fatal and injury accident involvements
		0					9C	° LF-9C is favoured over LF-1E for the province-wide hazard based spill index (one every 8.5 years versus one every 5.5 years) and the province-wide annual accidents involvements (1.4 per year versus 2.1 per year)
		0					9C	° when sensitivity analysis undertaken (see Chapter 8), which defines local and regional access system for Niagara Falls options as the exit point for LF-9C (Regional Road 24) - the preference clearly switches to LF-9C

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking
7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.9

Summary Arguments - Risk Rankings - LF-1E versus LF-9C

DISCIPLINE	DISTINCTIONS 1	2	3	4	5	6	7	REASONS/COMMENTS
Transportation (continued)			0				LD	• potential to reduce transportation risk in general and especially along local and regional access routes
Air		0					9C	• LF-9C preferred overall - with alternative weighting scheme
	0	0					9C	• arguable that direct air pathways at margin of acceptability - risk of additional cancer is one in a million
		0					9C	• for incinerator stack emissions (chronic); higher suitability levels (-3.8 existing, -2.6 future) for LF-1E and (-1.3 existing, -1.2 future) for LF-9C
		0					9C/ND	• for fugitive emissions (chronic) -1.9 (existing) for LF-1E and -1.3 (existing) for LF-9C (no differences for future)
		0					9C	• incinerator stack emissions (acute) - -1.4 (existing) and -1.6 (future) for LF-1E and -1.0 (existing) and -1.1 (future) for LF-9C
		0					9C	• low elevation emissions (acute); -4.5 (existing) and -3.4 (future) for LF-1E; -2.6 (existing) and -2.2 (future) for LF-9C
		0					ND	• overall factor suitability ratings the same - 2.3 for both options
		0	0	0			LD	• low likelihood of events; more uncertainty with acute events
	0	0					LD	• incremental chronic emission risks acceptable event with very conservative assumptions

Legend:

1 - Absolute Risk and Impacts	4 - Uncertainty	7 - Preference
2 - Relative Risk and Impacts	5 - Policy	ND - No Difference
3 - Mitigation	6 - Factor Ranking	LD - Limiting Difference

TABLE 6.9

Summary Arguments - Risk Rankings - LF-1E versus LF-9C

DISCIPLINE	DISTINCTIONS 1	2	3	4	5	6	7	REASONS/COMMENTS
Surface Water		0					1E	° LF-1E preferred overall
								° moderate constraints; potential for water use interference - 3.0 rating for LF-9C versus -1.0 for LF-1E
		0	0				ND	° no difference - susceptibility of site to flooding; constraints minor and mitigable
							LD	° surface water use differences not major for the following reasons:
		0					LD	- severe surface water risks addressed during previous site selection stages; constraints mitigable - contaminants retained on-site through design and operations
	0	0					LD	- no major sensitive uses such as a municipal water intake (existing or planned) downstream of the candidate sites
		0	0				LD	- in unlikely event of surface water release - the monitoring of water quality, the notification of owners, dilution and alternative water supplies could assist in avoiding potential human health effects
						0	LD	- surface water factor rankings - moderate
		0					LD	- difference between options narrows when surface and ground water uses are considered jointly; greater natural containment (LF-9C); limits ground/surface water connections

Legend:

1 - Absolute Risk and Impacts	4 - Uncertainty	7 - Preference
2 - Relative Risk and Impacts	5 - Policy	ND - No Difference
3 - Mitigation	6 - Factor Ranking	LD - Limiting Difference

(which redefined the local and regional access system) which clearly favours LF-9C. There is, therefore, a reasonable case for characterizing the transportation risk differences between the two options as moderate.

- The surface water difference between the two options results in a moderate to minor preference for LF-1E. The gap between the two options is narrowed somewhat when the ground and surface water disciplines are considered jointly, as a result of the greater natural containment offered by LF-9C. Surface water constraints are also potentially mitigable.

In conclusion, the minor surface water and moderate transportation risk differences favouring LF-1E do not offset the moderate air and major hydrogeologic risk differences favouring LF-9C. LF-9C is clearly preferred to LF-1E. However, the preference for LF-9C over LF-1E is not as great as the preference for LF-9C over LF-3C and LF-1E/PI-27E.

6.3.4 OVERALL RANKING OF OPTIONS - RISK

On the basis of the preceding analyses, the siting options are ranked from most to least preferred as follows:

- LF-9C;
- LF-1E;
- LF-3C and LF-1E/PI-27E;
- LF-4N/PI-1N;
- LF-4N/PI-13N.

LF-4N/PI-13N is considerably less desirable than the other five options. A fairly broad gap occurs between LF-4N/PI-1N and the four most highly ranked options. The four most highly ranked options are all clustered quite close together.

LF-9C is the preferred siting option, from a risk perspective. The comparison between LF-9C and LF-1E, LF-9C and LF-1E/PI-27E and LF-9C and LF-3C resulted in a clear preference for LF-9C. The differences among the remaining three siting options are very limited. The LF-1E - LF-1E/PI-27E comparison resulted in a slight preference for LF-1E. The LF-1E - LF-3C comparison resulted in a slight preference for LF-1E. The differences between LF-3C and LF-1E/PI-27E are too limited to indicate a clear preference. The ranking of the top options involves many difficult interpretations and tradeoffs.

6.4 SYNTHESIS OF RANKINGS BY IMPACT CONSULTANTS

6.4.1 INTRODUCTION

(a) Synthesis by Other Consultants

This section of Chapter 6 synthesizes the perspectives of the various impact consultants. Some initial synthesis has been undertaken by other site selection consultants. The social consultant (IER) combined the social and community impacts (IER) with tourism[1] (Laventhol and Horwath, and Jack Ellis and Associates Ltd.), visual (EDA Collaborative Inc.) and heritage resources (Historica Research Ltd.). The agricultural consultant (Ecologistics Ltd.) combined the agriculture resources and agricultural community impact analyses with the potential sensitive crop impacts. The land use consultant (Leon Kentridge Associates Ltd.) combined the existing, planned and proposed land use impact analysis with input on land appraisals (Graydon Rodgers

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[1] This synthesis viewed tourism in a social sense, i.e. impact on community image.

Associates Ltd.). Finally, the economic consultant (Clayton Research Associates Ltd.) assisted in the synthesis of the business (Clayton), agricultural (Ecologistics) and tourism (Laventhol and Horwath) economic impacts[1].

This synthesis does not include the archaeological siting option rankings prepared by the Museum of Indian Archaeology because:

- "the range of archaeological resources impacted between siting options was narrow (1 to 3)" (GLAL and MIA, 1985, p.117);

- "no distinction was made in the relative significance of one archaeological or historic site over another; all were treated as equally significant" (GLAL and MIA, 1985, p.117);

- "The Ontario Waste Management Corporation has made a commitment to mitigate all archaeological resources which might be impacted on the preferred site. Thus, although there are differences between the siting options in terms of the number of significant archaeological resources that would be impacted by facilities development, such archaeological resources were not considered to pose a severe constraint on facilities development. For this reason the factor of archaeological resources was ranked as one of the lowest in terms of the overall ranking of all impact factors..." (GLAL and MIA, 1985, pp.117 and 119).

The potential archaeological impacts are limited and mitigable. The differences among the siting options are slight. It is, therefore, not necessary to include an archaeological ranking of siting options in the disciplinary synthesis process.

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[1] This synthesis considered tourism in terms of economic base impacts. It is contained in Appendix E.

TABLE 6.10

Ranking of Siting Options by Impact Disciplines[1]

Rankings	Consultants						
	Agriculture (Ecologistics)	Social (IER)	Land Use (LKA)	Economic Base (Clayton)	Municipal Finance (Clayton)	Biology (GLAL)	Air (ORF)
1	LF-1E/PI-27E	LF-1E	LF-1E/PI-27E	LF-9C	LF-9C	LF-4N/PI-1N	LF-3C & LF-9C
2	LF-1E	LF-1E/PI-27E	LF-1E	LF-1E	LF-3C	LF-9C	LF-1E
3	LF-4N/PI-1N	LF-9C	LF-9C	LF-1E/PI-27E	LF-1E	LF-4N/PI-13N	LF-4N/PI-13N
4	LF-9C	LF-4N/PI-1N	LF-4N/PI-1N & LF-3C	LF-3C	LF-1E/PI-27E	LF-3C	LF-4N/PI-1N
5	LF-4N/PI-13N	LF-4N/PI-13N	-	LF-4N/PI-1N	LF-4N/PI-1N	LF-1E	-
6	LF-3C	LF-3C	LF-4N/PI-13N	LF-4N/PI-13N	LF-4N/PI-13N	LF-1E/PI-27E	LF-1E/PI-27E

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[1] The table ranks the siting options from most to least preferred. The relative magnitude and significance of differences between siting options is described in the text which follows and is summarized in Table D.2 in Appendix D.

(b) Approach

The same table and text format employed in the synthesis of risks is used in the synthesis of impacts. Arguments for and against each pair of options are summarized in a series of tables, using the same format employed in the risk integration. The text is also structured to initially group options into levels, i.e. clearly most or least desirable and then to evaluate the differences among options within the siting option groupings. A paired evaluation procedure is again employed.

Table 6.10 highlights the impact consultants' siting option rankings. Table D.2 in Appendix D provides a more detailed synopsis of the rationale for the rankings. It also highlights points relevant to interpretations of the relative and absolute magnitude and importance of the siting option rankings. This section of the report traces through the process for synthesizing the individual impact consultants' rankings.

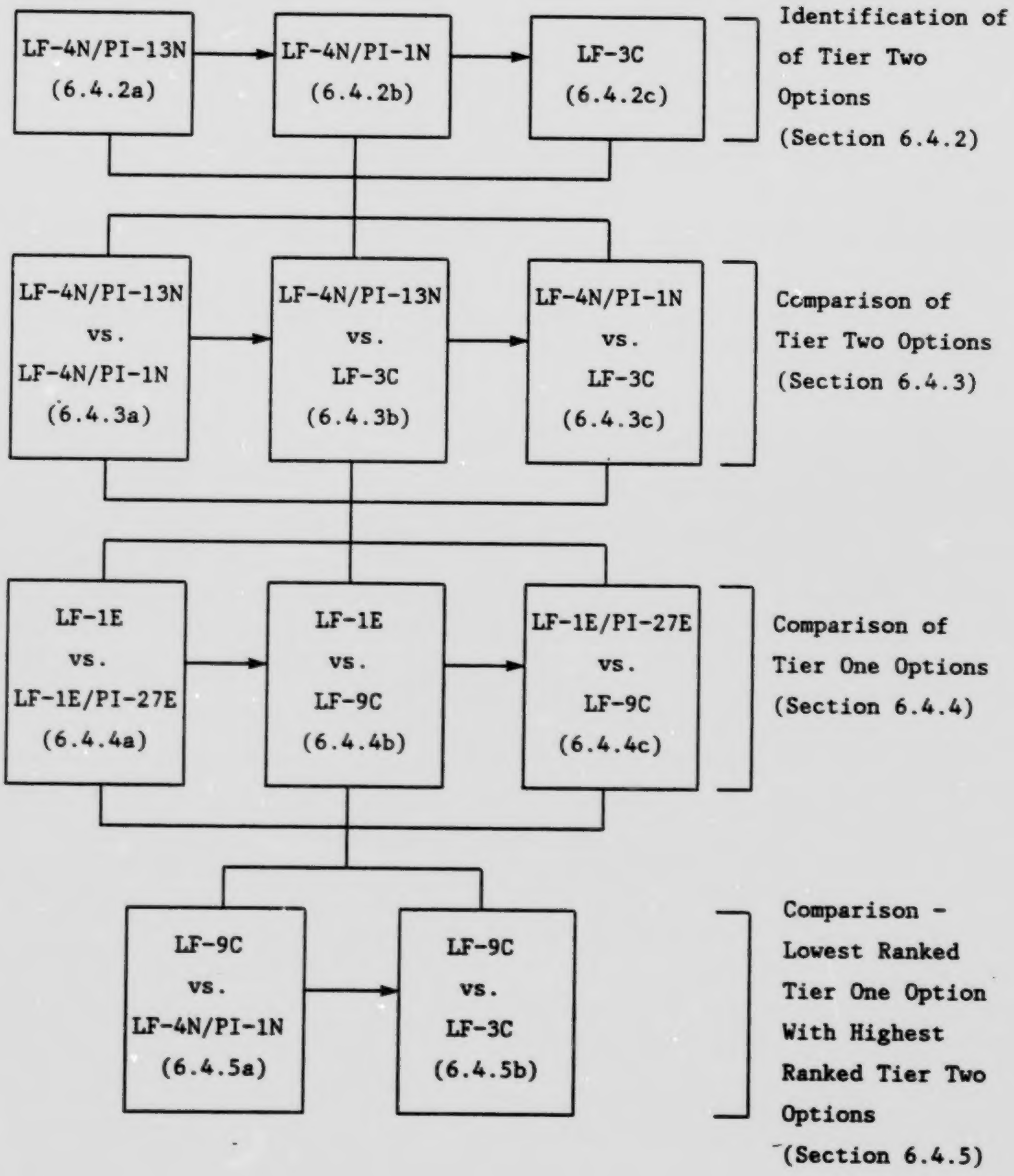
No siting option is clearly preferred to the remaining options. The options can, however, be grouped into two levels or tiers. The first level, comprised of LF-9C, LF-1E and LF-1E/PI-27E, represents options with a strong potential for being preferred overall. The second level, comprised of LF-3C, LF-4N/PI-1N and LF-4N/PI-13N, represents options with very limited potential for being preferred overall. The following steps were taken to test this initial impression (see Figure 6.3):

- each of the three options tentatively placed in the second tier were reviewed to determine whether the benefits favouring that option offset its limitations (Section 6.4.2). If such was the case placement within the first tier of options would have been warranted;

- the options remaining within the second tier were compared and ranked (Section 6.4.3);

FIGURE 6.3

Impact Siting Option Ranking Options


LF-4N/PI-13N (6.4.2a)
LF-4N/PI-1N (6.4.2b)
LF-3C (6.4.2c)
Identification of of Tier Two Options (Section 6.4.2)
LF-4N/PI-13N vs. LF-4N/PI-1N (6.4.3a)
LF-4N/PI-13N vs. LF-3C (6.4.3b)
LF-4N/PI-1N vs. LF-3C (6.4.3c)
Comparison of Tier Two Options (Section 6.4.3)
LF-1E vs. LF-1E/PI-27E (6.4.4a)
LF-1E vs. LF-9C (6.4.4b)
LF-1E/PI-27E vs. LF-9C (6.4.4c)
Comparison of Tier One Options (Section 6.4.4)
LF-9C vs. LF-4N/PI-1N (6.4.5a)
LF-9C vs. LF-3C (6.4.5b)
Comparison - Lowest Ranked Tier One Option With Highest Ranked Tier Two Options (Section 6.4.5)

- the options within the first tier were compared and ranked (Section 6.4.4);

- the lowest ranked option within the first tier was compared to the highest ranked option in the second tier to test whether the two tier distinction was valid (Section 6.4.5).

6.4.2 IDENTIFICATION OF TIER TWO OPTIONS

This review determines whether one of the second tier options could become the preferred siting option. For an option ranked among the least desirable by a number of consultants, to be preferred the following would need to occur:

- for the disciplines for which the siting option is not ranked highly, the differences between the siting option and the more highly ranked siting options would need to be quite limited;

- for the disciplines for which the siting option is ranked highly there would need to be clear, and possibly major, differences between it and the lower ranked siting options;

- the constraints associated with the siting option would need to be minor as reflected in absolute levels of impact, mitigation potential, and factor rankings.

(a) LF-4N/PI-13N

The land use, economic base and municipal finance consultants rank siting option LF-4N/PI-13N as the least preferred. It is ranked fifth by the agricultural and social consultants, fourth by the air impact consultant and third by the biology consultant. The third place biological ranking for LF-4N/PI-13N is sufficient to confirm the conclusion that LF-4N/PI-13N should not be the preferred siting option. Table 6.11 highlights the summary arguments pertinent to the impact ranking of LF-4N/PI-13N. The rationale for this conclusion is as follows:

- there are clear differences between LF-4N/PI-13N and other siting options ranked more highly for agriculture, social, land use, economic base, municipal finance and air impacts;
- there are slight biological differences between LF-4N/PI-13N and four of the other siting options. Biological factors are not generally ranked as highly as the most highly ranked agriculture, social, land use and economic base factors, factors for which LF-4N/PI-13N receives low rankings;
- the constraints associated with LF-4N/PI-13N are significant, i.e. highly ranked factors, not necessarily mitigable impacts, certainty regarding impact potential and potentially high absolute levels of impacts; conclusion applies particularly to potential agriculture, social, land use and economic base impacts.

(b) LF-4N/PI-1N

The economic base, municipal finance and air impact consultants all rank LF-4N/PI-1N fifth. It is ranked fourth by the social and the land use consultants. The agriculture and biology consultants rank LF-4N/PI-1N third and first, respectively. In order for LF-4N/PI-1N to be one of the three most preferred siting options (and potentially the most preferred siting option), the agricultural and biological advantages favouring the option would have to more than offset its impact disadvantages. Table 6.12 highlights the summary arguments pertinent to the impact ranking of LF-4N/PI-1N. The rationale for the conclusion that LF-4N/PI-1N should not be the preferred siting option is as follows:

TABLE 6.11

Summary Arguments - Impact Ranking of LF-4N/PI-13N

DISCIPLINE	DISTINCTIONS 1	2	3	4	5	6	REASONS/COMMENTS
Agriculture		0					° LF-4N/PI-13N is ranked fifth
		0					° gap between LF-4N/PI-13N and sixth ranked option (LF-3C) less than gap between LF-4N/PI-13N and fourth ranked option (LF-4N/PI-1N) - "slightly better siting option than LF-3C due mainly to lower access road impacts" (Ecologistics, 1985, p.162)
	0		0	0		0	° highly ranked factors - impacts may not be mitigable, adequate certainty re. impact potential; absolute impacts not necessarily low
Social		0					° LF-4N/PI-13N is ranked fifth
		0					° the IER numerical analysis places LF-4N/PI-13N closer to LF-3C (the sixth ranked option) than to LF-4N/PI-1N (the fourth ranked option)
		0					° gap between LF-3C and LF-4N/PI-13N broadened by qualitative adjustments for social stability and community character factors
	0		0	0		0	° highly ranked factors, impacts may not be mitigable, adequate certainty re. impact potential and absolute impacts are not necessarily low
Land Use		0					° LF-4N/PI-13N is ranked sixth
		0					° clear difference between LF-4N/PI-13N and fourth ranked option - reflection of the large number of residents in close proximity to site and in total site vicinity (LKA, 1985, p.139)

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking

TABLE 6.11

Summary Arguments - Impact Ranking of LF-4N/PI-13N

DISCIPLINE	DISTINCTIONS						REASONS/COMMENTS
	1	2	3	4	5	6	
Land Use (continued)	0						° highly ranked factors, impacts may not be mitigable, adequate certainty re. impact potential and absolute impacts are not necessarily low
Economic Base		0					° LF-4N/PI-13N is ranked sixth
		0					° clear difference between LF-4N/PI-13N and fifth ranked option
		0					° same ranking for businesses alone and when tourism, agriculture and business impacts are combined
	0		0	0		0	° highly ranked factors, impacts may not be mitigable, adequate certainty re. impact potential and absolute impacts are not necessarily low
Municipal Finance		0					° LF-4N/PI-13N is ranked sixth
		0					° LF-4N/PI-13N and LF-4N/PI-1N (the fifth ranked option) slight difference, but major difference between the Milton options and the fourth ranked option - LF-1E/PI-27E
	0		0	0			° mitigation potential, moderately ranked factors, absolute positive impacts likely to be low, adequate certainty re. impact potential
Biology		0					° LF-4N/PI-13N is ranked third
		0					° differences between LF-4N/PI-13N and first and second ranked options are slight (the top three options are all placed in Group A)

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking

TABLE 6.11

Summary Arguments - Impact Ranking of LF-4N/PI-13N

DISCIPLINE	DISTINCTIONS 1	2	3	4	5	6	REASONS/COMMENTS
Biology (continued)		0					° differences between LF-4N/PI-13N and the two options placed in Group B are also slight (GLAL, 1985a, p.130)
						0	° high factor ranking (level 8 and lower), although not as highly ranked as most highly ranked agriculture, social, land use and economic base factors
	0		0	0			° impacts may not be mitigable, adequate certainty re. impact potential for decision-making purposes; absolute impacts not necessarily low
Air		0					° LF-4N/PI-13N is ranked fourth
							° gap between LF-4N/PI-13N and the third ranked option is slightly wider than the gap between LF-4N/PI-13N and the fifth ranked option (LF-4N/PI-1N)
	0		0	0		0	° moderate to low factor rankings; mitigation is not expected to be required; absolute impacts expected to be low; adequate certainty re. impact potential

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking

TABLE 6.12

Summary Arguments - Impact Ranking of LF-4N/PI-1N

DISCIPLINE	CRITERIA 1	2	3	4	5	6	REASONS/COMMENTS
Agriculture		0					• LF-4N/PI-1N is ranked third
							• a clear gap between LF-4N/PI-1N and second ranked option LF-1E is "...much more suitable than LF-4N/PI-1N" (Ecologistics, 1985, p.182)
		0					• slight gap between LF-4N/PI-1N and LF-9C (fourth ranked option); LF-4N/PI-1N "a slightly better siting option than LF-9C" (Ecologistics, 1985, p.162)
		0					• LF-4N/PI-1N closer to lower ranked options than higher ranked options
		0					• major difference between LF-4N/PI-1N and most highly ranked options - LF-1E and LF-1E/PI-27E
			0	0		0	• highly ranked factors, impacts may not be mitigable, adequate certainty re. impact potential, absolute impacts not necessarily low
Social		0					• LF-4N/PI-1N is ranked fourth
		0					• gaps between LF-4N/PI-1N and the third ranked option (LF-9C) and between LF-4N/PI-1N and LF-4N/PI-13N clear and approximately equal based on the IER numerical analysis
		0					• qualitative adjustments based on greater importance attached to community character and social cohesion widens gap between LF-9C and LF-4N/PI-1N
		0					• major difference between LF-4N/PI-1N and the top two ranked siting options - LF-1E and LF-1E/PI-27E

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking

TABLE 6.12

Summary Arguments - Impact Ranking of LF-4N/PI-1N

DISCIPLINE	CRITERIA 1	2	3	4	5	6	REASONS/COMMENTS
Social (continued)	0			0	0	0	° highly ranked factors, impacts may not be mitigable, adequate certainty re. impact potential, absolute impacts not necessarily low
Land Use		0					° LF-4N/PI-1N is ranked fourth (together with LF-3C)
		0					° clear gap between LF-4N/PI-1N and the third ranked option - LF-9C
		0					° clear gap between LF-4N/PI-1N and the lowest ranked option - LF-4N/PI-13N
	0		0	0		0	° highly ranked factors, impacts may not be mitigable, adequate certainty re. impact potential, absolute impacts not necessarily low
Economic Base		0					° LF-4N/PI-1N is ranked fifth
		0					° gap between LF-4N/PI-1N and LF-3C (the fourth ranked option) is greater than that between LF-4N/PI-1N and LF-4N/PI-13N (the sixth ranked option)
		0					° LF-4N/PI-1N also ranked fifth when agricultural, business and tourism economic impacts are combined; gap between LF-4N/PI-1N and fourth ranked option LF-3C
		0					° major difference between LF-4N/PI-1N and top ranked option - LF-9C
	0		0	0		0	° highly ranked factors, impacts may not be mitigable, adequate certainty re. impact potential, absolute impacts not necessarily low

Legend:

1 - Absolute Risk and Impacts	4 - Uncertainty
2 - Relative Risk and Impacts	5 - Policy
3 - Mitigation	6 - Factor Ranking

TABLE 6.12

Summary Arguments - Impact Ranking of LF-4N/PI-1N

DISCIPLINE	CRITERIA						REASONS/COMMENTS
	1	2	3	4	5	6	
Municipal Finance		0					° LF-4N/PI-1N is ranked fifth
		0					° clear gap between LF-4N/PI-1N and fourth ranked option - LF-1E/PI-27E
		0					° difference between LF-4N/PI-1N and the sixth ranked option - LF-4N/PI-13N is slight
		0					° if LF-4N/PI-1N selected by Halton as preferred site for a new sanitary landfill, LF-4N/PI-1N would be ranked lower than LF-4N/PI-13N (the sixth ranked option)
	0		0	0		0	° mitigation potential, moderately ranked factor, absolute positive impacts likely to be low, some uncertainty re. impact potential, i.e. conflict with Region of Halton landfill site selection
Biology		0					° LF-4N/PI-1N is ranked first
		0					° slight difference between LF-4N/PI-1N and two other options (LF-4N/PI-13N and LF-9C)
		0					° moderate difference between Group A and two siting options (LF-3C and LF-1E)
						0	° high to moderate factor ranking (level 8 and lower), although not as high as most highly ranked social, land use and economic base factors
	0		0	0			° impacts may not be mitigable and adequate certainty re. impact potential for decision-making purposes; absolute impacts not necessarily low
Air		0					° LF-4N/PI-1N is ranked fourth; LF-4N/PI-13N is ranked fifth

Legend:

1 - Absolute Risk and Impacts	4 - Uncertainty
2 - Relative Risk and Impacts	5 - Policy
3 - Mitigation	6 - Factor Ranking

TABLE 6.12

Summary Arguments - Impact Ranking of LF-4N/PI-1N

DISCIPLINE	CRITERIA						REASONS/COMMENTS
	1	2	3	4	5	6	
Air (continued)	0		0				° slight differences between LF-4N/PI-1N and fifth ranked option - LF-4N/PI-13N; greater restraint to air dispersion with PI-1N as a result of its proximity to the Niagara Escarpment; minor mitigable constraint
		0					° very slight differences between LF-4N/PI-1N and LF-4N/PI-13N for existing and anticipated air quality
	0		0	0		0	° moderate to low factor rankings, mitigation not expected to be required, absolute impacts expected to be low, adequate certainty re. impact potential

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking

- there are clear differences between LF-4N/PI-1N and the siting options ranked more highly for social, land use, economic base, municipal finance and air impacts;

- there are slight agricultural differences between LF-4N/PI-1N and more lowly ranked options; there are major agricultural differences between LF-4N/PI-1N and the most highly ranked options;

- there are slight biological differences between LF-4N/PI-1N and two siting options (LF-9C and LF-4N/PI-13N); there are moderate biological differences between LF-4N/PI-1N and two other siting options (LF-3C and LF-1E); biological factors are not generally ranked as highly as the social, land use and economic base factors which ranked LF-4N/PI-1N among the least desirable siting options;

- the constraints associated with LF-4N/PI-1N are significant, i.e. highly ranked factors, not necessarily mitigable impacts, adequate certainty regarding impact potential, and potentially high absolute levels of impacts; this conclusion applies particularly to potential social, land use and economic base impacts.

(c) LF-3C

The agriculture and social consultants rank LF-3C sixth overall. The land use, biology and economic base consultants rank LF-3C fourth. LF-3C is, ranked second by the municipal finance consultant and first (together with LF-9C) by the air impact consultant. Table 6.13 highlights the summary arguments pertinent to the impact ranking of LF-3C. The rationale for the conclusion that LF-3C should not be the preferred siting option is as follows:

- LF-3C is the least desirable option from a social and an agricultural perspective; there are clear differences between LF-3C and the more highly ranked options;

TABLE 6.13

Summary Arguments - Impact Ranking of LF-3C

DISCIPLINE	DISTINCTIONS 1	2	3	4	5	6	REASONS/COMMENTS
Agriculture		0					° LF-3C is ranked sixth
		0					° clear difference between LF-3C and LF-4N/PI-13N (the fifth ranked option)
		0					° wider difference between LF-3C, LF-4N/PI-13N and LF-9C - the fourth ranked option
		0					° major difference between LF-3C and the most highly ranked options
	0		0	0		0	° highly ranked factors, impacts may not be mitigable, adequate certainty re. impact potential; absolute impacts not necessarily low
Social		0					° LF-3C is ranked sixth
		0					° gap between LF-3C and LF-4N/PI-13N (the fifth ranked siting option) comparatively minor based on the IER numerical analysis
		0					° gap widened based on qualitative adjustments (greater emphasis on community character and social cohesion differences); LF-3C clearly least desirable siting option
		0					° major difference between LF-3C and most highly ranked options
	0		0	0		0	° highly ranked factors, impacts may not be mitigable, adequate certainty re. impact potential; absolute impacts not necessarily low
Land Use		0					° LF-3C is ranked fourth, together with LF-4N/PI-1N

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking

TABLE 6.13

Summary Arguments - Impact Ranking of LF-3C

DISCIPLINE	DISTINCTIONS						REASONS/COMMENTS
	1	2	3	4	5	6	
Land Use (continued)		0					° LF-3C clearly less preferred than LF-9C; with LF-9C, more residences on site, in the site vicinity and along the access roads
		0					° major difference between LF-3C and most highly ranked options
	0		0	0		0	° highly ranked factors, impacts may not be mitigable, adequate certainty re. impact potential, absolute impacts not necessarily low
Economic Base		0					° LF-3C is ranked fourth
		0					° LF-3C clearly less preferred than LF-1E/PI-27E, the third ranked option
		0					° LF-3C is ranked fourth when economic base, agriculture and tourism economic impacts are combined; slight differences between LF-3C and LF-1E/PI-27E, the third ranked option; moderate differences between LF-1E (the second ranked option) and LF-3C; major difference between LF-9C (the top ranked option) and the remaining options
	0		0	0		0	° highly ranked factors, impacts may not be mitigable, adequate certainty re. impact potential, absolute impacts not necessarily low
Municipal Finance		0					° LF-3C is ranked second
		0					° slight difference between LF-3C and LF-9C (the top ranked siting option)
		0					° clear difference between LF-3C and third ranked option - LF-1E

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking

TABLE 6.13

Summary Arguments - Impact Ranking of LF-3C

DISCIPLINE	DISTINCTIONS 1	2	3	4	5	6	REASONS/COMMENTS
Municipal Finance (continued)		0					° some qualitative considerations close gap between LF-3C and LF-9C and remaining options: - concern of Township whether OWMC will bear all municipal capital works costs associated with facility - concern of Township re. incremental costs, e.g. permanent rather than voluntary fire department, need for additional services such as planning and engineering
						0	° municipal finance - moderately ranked factor (level 4)
					0		° OWMC commitment that no municipality will suffer financially
	0						° in absolute terms, adverse municipal finance impacts limited; negative impacts on operating costs are offset by revenue increases
			0				° no adverse municipal finance impacts, to the extent that they occur are mitigable
		0					° municipal financial advantages possessed by LF-3C also possessed by LF-9C
Biology		0					° LF-3C is ranked fourth
							° difference between LF-3C and other option in Group B (LF-1E) slight
		0					° difference between LF-3C and third ranked siting option (LF-4N/PI-13N) slight
		0					° clear difference between Group B options and sixth ranked option - LF-1E/PI-27E

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking

TABLE 6.13

Summary Arguments - Impact Ranking of LF-3C

DISCIPLINE	DISTINCTIONS 1	2	3	4	5	6	REASONS/COMMENTS
Biology (continued)	0		0	0		0	° impacts may not be mitigable and adequate certainty re. impact potential for decision-making purposes; absolute impacts not necessarily low
Air		0					° LF-3C (together with LF-9C) - the most preferred siting option
		0					° LF-3C (and LF-9C) clearly preferred over third ranked option
						0	° air impact factors moderately ranked (levels 6 and 2)
	0		0				° minimal air dispersion constraints (sites with significant constraint avoided in earlier stages); to the extent that constraints exist could be readily mitigated
					0		° air quality - facility emissions - well within applicable standards and guidelines - 1% or less for the incinerator stack emissions and 10% or less for fugitive emissions (ORF, 1985, p.64)
	0						° incremental effects on air quality - extremely small
		0					° air impact advantages possessed by LF-3C also possessed by LF-9C
			0				° mitigation not expected to be required

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking

- LF-3C is clearly less desirable than the more highly ranked options from land use and economic base perspectives; LF-3C is less desirable from a biological perspective than the three more highly ranked options;
- the municipal finance advantages possessed by LF-3C are tempered somewhat by qualitative considerations, e.g. incremental costs; municipal finance is a moderately ranked factor (level 4); it has a much lower ranking than the highest ranked social, agricultural, land use and economic base factors; municipal financial concerns are low in an absolute sense and mitigable (OWMC has made a commitment that no municipality will suffer financially);
- the air impact advantages possessed by LF-3C are somewhat tempered by recognition that the air impact factors are moderately ranked (levels 6 and 2); impacts are also low in an absolute sense and mitigation is not expected to be required;
- there are no advantages possessed by LF-3C which are not also possessed by LF-9C; there are, however, major disadvantages possessed by LF-3C which are not possessed by LF-9C.

(d) Conclusion

On the basis of the preceding analysis, none of the three Tier 2 options - LF-4N/PI-13N, LF-4N/PI-1N and LF-3C, are preferred from an overall impact perspective.

All of the remaining siting options have sufficient relative advantages such that they could be selected as the preferred siting option.

LF-9C is only ranked fourth by one discipline - agriculture. LF-9C is ranked first by three impact consultants (economic base, municipal finance, air), second by one impact consultant (biology) and third by two impact consultants (land use, social). The biology consultant is the only consultant who ranks LF-1E among the three least desirable siting options. LF-1E/PI-27E is ranked sixth by two consultants (biology and air) and fourth by another consultant (municipal finance). It is, however, also the preferred option of two consultants (land use, agriculture) and the second most preferred option by a third consultant (social). The less favoured rankings for LF-1E/PI-27E are largely for moderately ranked factors. The favourable rankings for LF-1E/PI-27E are largely for highly ranked factors.

6.4.3 COMPARISON OF TIER TWO OPTIONS

In this section, a series of paired comparisons are undertaken to compare the three Tier 2 options - LF-4N/PI-13N, LF-4N/PI-1N and LF-3C.

(a) LF-4N/PI-13N versus LF-4N/PI-1N

LF-4N/PI-1N is preferred to LF-4N/PI-13N by all consultants, with the exception of the air quality consultant. The air dispersion differences between the two options, which result in the preference for LF-4N/PI-13N, are not sufficient to offset the disadvantages associated with LF-4N/PI-13N. The major differences between the two options are highlighted in Table 6.14. The reasons for this conclusion are provided below:

- there are clear agriculture, social, land use and economic base differences between the options, all favouring LF-4N/PI-1N. The combination of agriculture, business and tourism economy did not change the preference for LF-4N/PI-1N over LF-4N/PI-13N[1];

- LF-4N/PI-1N is preferred to LF-4N/PI-13N by the biology and municipal finance consultants. In the case of municipal finance, there is one consideration, the possible selection of PI-1N by the Region of Halton

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[1] A separate analysis (see Appendix E) was carried out by Clayton Research Associates Ltd. which combined the economic base (industrial), tourism and agricultural economic impacts.

TABLE 6.14

Summary Arguments - Impact Rankings - LF-4N/PI-13N versus LF-4N/PI-1N

DISCIPLINE	CRITERIA							REASONS/COMMENTS
	1	2	3	4	5	6	7	
Agriculture		0					4N/1N	° LF-4N/PI-1N and LF-4N/PI-13N are ranked third and fifth, respectively
		0					4N/1N	• LF-4N/PI-1N is only slightly better than the fourth ranked option LF-9C (LF-4N/PI-1N impacts are moderate)
		0					4N/1N	• LF-4N/PI-13N is only slightly better than the sixth ranked siting option - LF-3C
		0					4N/1N	• LF-4N/PI-1N is clearly preferred to LF-4N/PI-13N; major differences - displacement of farms, disruption of adjacent farms, access road impacts and farm economy disruption
		0					4N/13N	• slight preference - LF-4N/PI-13N - loss of farmland, partial displacement of farms and stability of farm population and agricultural land base
Social		0					4N/1N	• LF-4N/PI-1N and LF-4N/PI-13N are ranked fourth and fifth, respectively
		0					4N/1N	• LF-4N/PI-1N is clearly preferred to LF-4N/PI-13N based on IER numerical analysis; the gap between options is not altered by qualitative adjustments; differences favouring LF-4N/PI-1N - adjacent disruption and greater potential community and regional impacts
		0					4N/13N	• slight preference - favouring LF-4N/PI-13N - displacement and adjacent access roads
Land Use		0					4N/1N	• LF-4N/PI-1N and LF-4N/PI-13N are ranked fourth and sixth, respectively

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking
7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.14

Summary Arguments - Impact Rankings - LF-4N/PI-13N versus LF-4N/PI-1N

DISCIPLINE	CRITERIA						7	REASONS/COMMENTS
	1	2	3	4	5	6		
Land Use (continued)		0					4N/1N	° clear preference for LF-4N/PI-1N over LF-4N/PI-13N because of significantly less residences in site vicinity, less residential uses along access roads, and closer proximity of sites with LF-4N/PI-1N (more like an integrated option) (LKA, 1985, p.138)
		0					4N/13N	° moderate preference - favouring LF-4N/PI-13N - land use stability and provincial policies and plans
Economic Base		0					4N/1N	° LF-4N/PI-1N and LF-4N/PI-13N are ranked fifth and sixth, respectively
		0					4N/1N	° major difference between two options - a reflection of the greater negative property value impacts and the larger negative impacts on existing businesses
		0					4N/13N	° LF-4N/PI-13N - moderate difference - business displacement
		0					4N/1N	° the combination of agriculture, business and tourism economy resulted in a fifth and sixth ranking for LF-4N/PI-1N and LF-4N/PI-13N, respectively
		0					4N/1N	° major differences between options are based largely on economic base differences
Municipal Finance		0					4N/1N	° LF-4N/PI-1N and LF-4N/PI-13N are ranked fifth and sixth, respectively
		0					4N/1N	° only a slight difference between options

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation

4 - Uncertainty
5 - Policy
6 - Factor Ranking

7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.14

Summary Arguments - Impact Rankings - LF-4N/PI-13N versus LF-4N/PI-1N

DISCIPLINE	CRITERIA 1	2	3	4	5	6	7	REASONS/COMMENTS
Municipal Finance (continued)		0					4N/13N	• if Region of Halton selects PI-1N as regional sanitary landfill site, ranking of options is reversed
Biology		0					4N/1N	• LF-4N/PI-1N and LF-4N/PI-13N are ranked first and third, respectively; both options placed in Group A
		0					LD	• differences between options slight
Air		0					4N/1N	• LF-4N/PI-13N and LF-4N/PI-1N are ranked fourth and fifth, respectively
		0					LD	• slight differences based on ORF option scores (-2.6 and -2.7)
		0					4N/1N	• basis of difference - greater restraints to dispersion at PI-1N
							LD	• restraints to dispersion - low factor ranking (level 2)
	0		0				LD	• air dispersion impacts considered minimal and readily mitigable

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation

4 - Uncertainty
5 - Policy
6 - Factor Ranking

7 - Preference
ND - No Difference
LD - Limiting Difference

as its preferred site for a sanitary landfill, which would reverse the rankings. This conflict is only a possible constraint. The preferred option, therefore, is selected first. The possible conflict between the OWMC and the Region of Halton site selection process is only considered in the event of minor differences between the siting options. For the reasons cited in this subsection, the differences favouring LF-4N/PI-1N over LF-4N/PI-13N are more than minor;

- the air impact differences between the two options are slight. The basis for the air impact differences is a greater dispersion constraint with LF-4N/PI-1N. This constraint is minor. Mitigation is not expected to be necessary. If mitigation is necessary, it could be readily instituted.

(b) LF-4N/PI-13N versus LF-3C

The comparison between LF-4N/PI-13N and LF-3C involves some tradeoffs. LF-4N/PI-13N is favoured by the agriculture, social (very slightly) and biology consultants. LF-3C is favoured by the land use, economic base, municipal finance and air quality consultants. The major differences between the two options are highlighted in Table 6.15. For the reasons cited below, LF-3C is preferred to LF-4N/PI-13N:

- there are clear land use and air impact differences favouring LF-3C; there is a strong economic base preference for LF-3C over LF-4N/PI-13N;

- there is a major municipal finance difference between the options favouring LF-3C;

- the agriculture and biology differences favouring LF-4N/PI-13N over LF-3C are slight;

TABLE 6.15

Summary Arguments - Impact Rankings - LF-4N/PI-13N versus LF-3C

	CRITERIA							
DISCIPLINE	1	2	3	4	5	6	7	REASONS/COMMENTS
Agriculture		0					4N/13N	° LF-4N/PI-13N and LF-3C are ranked fifth and sixth, respectively
		0					4N/13N	° differences between options small; contrast - LF-4N/PI-13N is an option with two sites (larger size), but situated in a less stable agricultural community; LF-3C occupies a smaller area in the heart of stable agricultural community
Social		0					4N/13N	° LF-4N/PI-13N and LF-3C are ranked fifth and sixth, respectively
		0					LD	° based on IER numerical analysis, differences limited; major tradeoff - greater residential displacement and site vicinity (residential and community and recreation features) impacts with LF-4N/PI-13N as compared with greater access route and social stability impacts with LF-3C
		0					4N/13N	° qualitative adjustments widen the gap between the two siting options as a result of greater potential impacts on social cohesion and community character
Land Use		0					4N/13N	° LF-4N/PI-13N and LF-3C ranked fourth and sixth, respectively
		0					4N/13N	° clear preference based on LKA numerical analysis
		0					4N/13N	° slightly greater site and much greater site vicinity impacts with LF-4N/PI-13N; more than offset greater access road and community and regional impacts with LF-3C

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking
7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.15

Summary Arguments - Impact Rankings - LF-4N/PI-13N versus LF-3C

	CRITERIA							
DISCIPLINE	1	2	3	4	5	6	7	REASONS/COMMENTS
Economic		0					3C	° LF-3C and LF-4N/PI-13N are ranked fourth and sixth, respectively
		0					3C	° major difference favouring LF-3C for economic base components; much greater property value and negative business impacts
		0					3C	° major difference favouring LF-3C for combination of economic base, agriculture and tourism economic impacts; major economic base and slight tourism impact differences favouring LF-3C more than offset moderate differences - agricultural economy - favouring LF-4N/PI-13N
Municipal Finance		0					3C	° LF-3C and LF-4N/PI-13N are ranked second and sixth, respectively
		0					3C	° major difference favouring LF-3C; with LF-3C large positive impacts, because of small municipal tax base, lower levels of service and lower potential property value impacts; with LF-4N/PI-13N much less positive impacts - payment-in-lieu of taxes (because of unusual municipal tax levy situation), greater negative property value impacts, reduced property taxes with two sites
		0					LD	° qualitative considerations: - Milton: municipal officials raised concerns re. assimilation capacity of sewage treatment plant, incremental costs, e.g. fire department, staffing, staff time for inquiries, capital works projects

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking
7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.15

Summary Arguments - Impact Rankings - LF-4N/PI-13N versus LF-3C

DISCIPLINE	CRITERIA							REASONS/COMMENTS
	1	2	3	4	5	6	7	
Municipal Finance (continued)								- West Lincoln: concern of Township whether OWMC will bear all municipal capital works associated with facility; concern of Township re. incremental costs, e.g. permanent rather than voluntary fire department, need for additional services such as planning and engineering
						0	LD	° municipal finance - moderately ranked factor (level 8)
			0		0		LD	° OWMC commitment that no municipality will suffer financially
	0		0				LD	° in absolute terms, adverse municipal finance impacts limited; negative impacts on operating costs offset by revenue increases
			0				LD	° net adverse municipal finance impacts to the extent that they occur are mitigable
		0					LD	° municipal financial advantages possessed by LF-3C also possessed by LF-9C
Biology		0					4N/13N	° LF-4N/PI-13N and LF-3C are ranked third and fourth, respectively
		0					LD	° although LF-4N/PI-13N is ranked higher than LF-3C, the differences between the options are slight
Air		0					3C	° LF-3C and LF-4N/PI-13N are ranked first and fourth, respectively

Legend:

1 - Absolute Risk and Impacts	4 - Uncertainty	7 - Preference
2 - Relative Risk and Impacts	5 - Policy	ND - No Difference
3 - Mitigation	6 - Factor Ranking	LD - Limiting Difference

TABLE 6.15

Summary Arguments - Impact Rankings - LF-4N/PI-13N versus LF-3C

DISCIPLINE	CRITERIA 1	2	3	4	5	6	7	REASONS/COMMENTS
Air (continued)		0					3C	° LF-3C preferred - restraints to dispersion and existing and anticipated air quality
		0					3C	° clear difference between options
						0	LD	° air impact factors moderately ranked (levels 6 and 2)
	0		0				LD	° minimal air dispersion constraints (sites with significant constraints avoided at an earlier stage); to the extent that constraints exist could be readily mitigated
	0				0		LD	° air quality - facility emissions well within applicable standards and guidelines - 1% or less for the incinerator stack emissions and 10% or less for fugitive emissions (ORF, 1985, p.64)
	0						LD	° incremental effects on air quality - extremely small
		0					LD	° air impact advantages possessed by LF-3C also possessed by LF-9C

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking
7 - Preference

- the social differences favouring LF-4N/PI-13N over LF-3C are slight based on the IER numerical analysis; the gap between the two options is widened somewhat by qualitative adjustments;
- questions of mitigation potential and absolute impacts do not favour either option with land use and economic considerations favouring LF-3C and social and agricultural considerations favouring LF-4N/PI-13N;
- the factor rankings do not favour one option over the other; if a case can be made, LF-3C is favoured as the direct on site and site vicinity disruption factors are ranked more highly than the community and region and access road factors favouring LF-4N/PI-13N.

In the final analysis, the magnitude of land use, economic base, municipal finance and air impact differences (favouring LF-3C) more than offset the more minor biological, agricultural and social differences favouring LF-4N/PI-13N.

(c) LF-4N/PI-1N versus LF-3C

The comparison between LF-4N/PI-1N and LF-3C involves some difficult tradeoffs. LF-4N/PI-1N is favoured by the agricultural, social and biology consultants. LF-3C is favoured by the economic base, municipal finance and air impact consultants. The land use consultant ranks the two options at the same level. The major differences between the two options are highlighted in Table 6.16. There is no clear preference between the two options. The major reasons for this conclusion are as follows:

- LF-4N/PI-1N is moderately preferred by the social, biology and agricultural consultants; LF-3C is clearly preferred by the economic base consultant; LF-3C is strongly preferred by the municipal finance and air impact consultants;

TABLE 6.16

Summary Arguments - Impact Rankings - LF-4N/PI-1N versus LF-3C

DISCIPLINE	CRITERIA							REASONS/COMMENTS
	1	2	3	4	5	6	7	
Agriculture		0					4N/1N	° LF-4N/PI-1N and LF-3C are ranked third and sixth, respectively; with LF-4N/PI-1N, most impacts are moderate; LF-4N/PI-1N is slightly better than LF-9C (the fourth ranked option)
		0					4N/1N	° LF-3C has high on-site, vicinity, community and access road impacts; LF-3C is slightly worse than fifth ranked option LF-4N/PI-13N
		0					4N/1N	° clear difference between LF-4N/PI-1N and LF-3C
							4N/1N	° LF-3C has greater farm displacement, off-site . disruption, access road impacts, and community and regional impacts
							3C	° LF-4N/PI-1N has greater loss of farmland
Social		0					4N/1N	° LF-4N/PI-1N and LF-3C are ranked fourth and sixth, respectively; clear difference based on IER numerical analysis; gap is widened by qualitative analysis which emphasizes social cohesion and community character considerations
		0					3C	° preference for LF-3C based on displacement and site vicinity impacts being more than offset by major access road and community and regional impacts
Land Use		0					ND	° LF-4N/PI-1N and LF-3C are ranked at the same level

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking
7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.16

Summary Arguments - Impact Rankings - LF-4N/PI-1N versus LF-3C

DISCIPLINE	CRITERIA							REASONS/COMMENTS
	1	2	3	4	5	6	7	
Land Use (continued)		0					3C 4N/1N	° moderate preference in site, site vicinity and community and regional study areas for LF-3C; strong preference for LF-4N/PI-1N for community and regional impacts
		0					3C 4N/1N	° LKA quantitative analysis favours LF-3C, but qualitative analysis emphasizes much greater land use stability at LF-3C; LF-4N/PI-1N in, "...transitional area in which former agricultural land use pattern is being urbanized as exemplified by the proposed landfill on LF-4N" (LKA, 1985, pp.132-133)
		0					ND	° no clear preference
							3C	° land use conflicts likely to increase over time in transitional areas
		0					ND	° vicinity of both options largely designated for agricultural use
Economic Base		0					3C	° LF-3C and LF-4N/PI-1N are ranked fourth and fifth, respectively
		0					3C	° clear difference favouring LF-3C; less business displacement, property value impacts and community and regional impacts favouring LF-3C more than offsets business activity differences which favour LF-4N/PI-1N
		0					3C	° when economic base, agriculture and tourism impacts combined, rankings unchanged but gap narrowed; clear difference still evident; economic base and slight tourism differences more than offset agriculture economy differences

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation

4 - Uncertainty
5 - Policy
6 - Factor Ranking

7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.16

Summary Arguments - Impact Rankings - LF-4N/PI-1N versus LF-3C

DISCIPLINE	CRITERIA 1	 2	 3	 4	 5	 6	7	REASONS/COMMENTS
Municipal Finance		0					3C	° LF-3C and LF-4N/PI-1N ranked second and fifth, respectively
		0					3C	° major difference favouring LF-3C; with LF-3C large positive impacts because of small municipal tax base, lower levels of service and lower potential property value impacts; with LF-4N/PI-1N much less positive impacts - payment-in-lieu of taxes (because of unusual tax levy situation) greater negative property value impacts, reduced property taxes with two sites
		0					LD	° qualitative considerations - Milton: municipal officials raised concerns re. assimilation capacity of sewage treatment plant, incremental costs, e.g. fire department, staffing, staff time for inquiries, capital works projects - West Lincoln: concern of Township whether OWMC will bear all municipal capital works costs with facility; concern re. incremental costs, e.g. permanent rather than volunteer fire department, need for additional services such as planning and engineering
						0	LD	° municipal finance - moderately ranked factor (level 4)
	0		0		0		LD	° OWMC commitment that no municipality will suffer financially; in absolute terms, adverse municipal finance impacts limited; negative impacts on operating costs are offset by revenue increases

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking
7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.16

Summary Arguments - Impact Rankings - LF-4N/PI-1N versus LF-3C

DISCIPLINE	CRITERIA 1	2	3	4	5	6	7	REASONS/COMMENTS
Municipal Finance (continued)			0				LD	° net adverse municipal finance impacts, to the extent that they occur are mitigable
		0					LD	° municipal financial advantages possessed by LF-3C also possessed by LF-9C
		0					3C	° if Region of Halton selects PI-1N as regional landfill site, LF-4N/PI-1N is ranked sixth
Biology		0					4N/1N	° LF-4N/PI-1N and LF-3C are ranked first and fourth, respectively
		0					4N/1N	° as compared with the three siting options in Group A (LF-4N/PI-1N, LF-9C and LF-4N/PI-13N), LF-3C noted as having somewhat higher site, site vicinity and access road constraints
		0					LD	° differences between options moderate
Air		0					3C	° LF-3C and LF-4N/PI-1N are ranked first and fifth, respectively
		0					3C	° major difference favouring LF-3C - restraints to dispersion; moderate difference - existing and anticipated air quality - also favours LF-3C
		0					3C	° clear difference between options
						0	LD	° air impact factors - moderately ranked (levels 6 and 2)

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking
7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.16

Summary Arguments - Impact Rankings - LF-4N/PI-1N versus LF-3C

DISCIPLINE	CRITERIA						7	REASONS/COMMENTS
	1	2	3	4	5	6		
Air (continued)	0		0				LD	° minimal air dispersion constraints (sites with significant constraints avoided at an earlier stage); to the extent that constraints exist, they are mitigable
					0		LD	° air quality (facility emissions) well within applicable standards and guidelines - 1% or less for the incinerator stack emissions and 10% or less for fugitive emissions (ORF, 1985, p.64)
	0						LD	° incremental effects on air quality extremely small
		0					LD	° air impact advantages possessed by LF-3C also possessed by LF-9C

Legend:

1 - Absolute Risk and Impacts	4 - Uncertainty	7 - Preference
2 - Relative Risk and Impacts	5 - Policy	ND - No Difference
3 - Mitigation	6 - Factor Ranking	LD - Limiting Difference

- the strong municipal finance and air impact preferences for LF-3C are tempered somewhat by moderate factor rankings, low absolute impacts and mitigation potential;

- highly ranked direct site and site vicinity factors favour LF-3C, but access road and community and regional considerations strongly favour LF-4N/PI-1N; there is a greater uncertainty regarding the magnitude of mitigation potential associated with community and regional impacts;

- the land use consultant ranks the two options at the same level;

- the stable agricultural area surrounding LF-3C favours LF-4N/PI-1N; the potential role of PI-1N as the landfill site for the Region of Halton favours LF-4N/PI-1N; the areas surrounding both options are designated for agricultural use; to the extent that change occurs more rapidly in the Milton area, conflicts with agriculture may be diminished (favours LF-4N/PI-1N), conflicts with rural, residential and recreation uses would, however, increase in the same area (favours LF-3C).

For the reasons cited above, there is no clear impact preference between LF-3C and LF-4N/PI-1N.

(d) Ranking of Tier Two Options

The following rankings result from the comparison of the three tier two options:

4th - LF-4N/PI-1N and LF-3C
6th - LF-4N/PI-13N.

6.4.4 COMPARISON OF TIER ONE OPTIONS

In this section, a series of paired analyses are undertaken to compare the three Tier One options - LF-1E, LF-1E/PI-27E and LF-9C.

(a) LF-1E versus LF-1E/PI-27E

The comparison between LF-1E and LF-1E/PI-27E involves some difficult tradeoffs. It also involves the analysis and interpretation of some key distinctions not readily apparent from factor suitability levels or factor rankings. LF-1E is preferred by the social, economic base, municipal finance, biology and air impact consultants. LF-1E/PI-27E is preferred by the land use and agricultural consultants. The initial impression created by this division would suggest a preference for LF-1E. However, a number of arguments, linked to the industrial designation of PI-27E, result in an overall preference for LF-1E/PI-27E. The differences between the options are highlighted in Table 6.17. The major reasons for the preference for LF-1E/PI-27E are highlighted below.

In reviewing the rankings and the rationales for these rankings by the various consultants, it is evident that a great deal depends on the importance attached to the industrial designation of PI-27E. If limited importance is attached to the designation, then LF-1E is clearly preferred. With LF-1E/PI-27E there are:

- more biological resources, businesses and farms displaced;
- more farms, residents and biological resources in close proximity to the sites;
- greater potential for property value reductions and greater municipal service costs.

As a result, the socio-economic considerations favour LF-1E. The biological and air impact concerns reinforce this preference.

TABLE 6.17

Summary Arguments - Impact Rankings - LF-1E versus LF-1E/PI-27E

DISCIPLINE	CRITERIA 1	2	3	4	5	6	7	REASONS/COMMENTS
Agriculture		0					1E/27E	• LF-1E/PI-27E and LF-1E are ranked first and second, respectively
		0					LD	• LF-1E/PI-27E slightly preferred to LF-1E
		0			0		1E/27E	• major difference is industrial designation of PI-27E
		0						• LF-1E/PI-27E is favoured for displacement of farms and farmland, non-adjacent farm disruption, stability of the land base and disruption to the farm economy
		0					1E	• LF-1E is favoured for disruption of adjacent farm operations
		0			0		1E/27E	• in considering displacement effects, the agricultural consultant does not include the land on PI-27E as the assumption is made that under an industrial designation will not likely remain in long-term agricultural use
Social		0					1E	• LF-1E and LF-1E/PI-27E are ranked first and second, respectively
		0					1E	• clear difference based on IER numerical analysis; no change based on qualitative analysis
		0					1E	• LF-1E is favoured - displacement of residents, disruption of daily activities - residents and community and recreation features adjacent to the site and in the site vicinity, social stability

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking
7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.17

Summary Arguments - Impact Rankings - LF-1E versus LF-1E/PI-27E

DISCIPLINE	CRITERIA							REASONS/COMMENTS
	1	2	3	4	5	6	7	
Social (continued)		0					1E/27E	° LF-1E/PI-27E is favoured - disruption of residents adjacent to access road and community character
Land Use		0					1E/27E	• LF-1E/PI-27E and LF-1E are ranked first and second, respectively
		0			0		1E/27E	• particular emphasis placed by land use consultant on industrial designation of PI-27E and close proximity to other heavy industrial uses, e.g. Ford Glass plant and Cyanamid; with LF-1E/PI-27E high degree of land use compatibility
		0					1E/27E	• LF-1E/PI-27E is preferred for site and site vicinity impacts
		0					1E	• LF-1E is preferred for community and regional area
							1E/27E	• clear difference between options
Economic Base		0					1E	° LF-1E and LF-1E/PI-27E are ranked second and third, respectively
		0					LD	• business impact differences are slight; both slightly positive
		0 0					1E 1E/27E	• greater displacement of business activities, property value impacts, negative business impacts and community and regional impacts - largely offset by much greater positive business impacts with LF-1E/PI-27E

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking
7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.17

Summary Arguments - Impact Rankings - LF-1E versus LF-1E/PI-27E

DISCIPLINE	CRITERIA							REASONS/COMMENTS
	1	2	3	4	5	6	7	
Economic Base (continued)		0					1E	° when economic impacts combined - moderate preference for LF-1E, slight agriculture impact difference favouring LF-1E/PI-27E, moderate tourism impacts and slight business impacts favouring LF-1E
Municipal Finance		0					1E	° LF-1E and LF-1E/PI-27E are ranked third and fourth, respectively
		0					LD	° slight to moderate differences between options
		0					1E	° lower ranking for siting option LF-1E/PI-27E due to greater reduced property taxes with two sites and due to negative property value impacts
	0						LD	° impacts positive for both siting options
Biology		0					1E	° LF-1E and LF-1E/PI-27E are ranked fifth and sixth, respectively
		0					1E	° LF-1E placed in Group B and LF-1E/PI-27E in Group C
		0					1E	° clear difference between options
		0					1E	° LF-1E/PI-27E - least preferred option - site and site vicinity impacts
		0					LD	° industrial designation - PI-27E not considered in the interpretation of potential biological impacts

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking
7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.17

Summary Arguments - Impact Rankings - LF-1E versus LF-1E/PI-27E

DISCIPLINE	CRITERIA							REASONS/COMMENTS
	1	2	3	4	5	6	7	
Air		0					1E	° LF-1E and LF-1E/PI-27E are ranked third and sixth, respectively
							1E	° no difference - restraints to dispersion; clear difference - existing and anticipated air quality
							1E	° clear difference between options
						0	LD	° air impact factors - moderately ranked (levels 6 and 2)
	0		0				LD	° minimal air dispersion constraints (sites with significant constraints avoided at an earlier stage) to the extent that constraints exist could be readily mitigated
					0		LD	° air quality - facility emissions - well within applicable standards and guidelines - 1% or less for the incinerator stack emissions and 10% or less for fugitive emissions (ORF, 1985, p.64)
	0						LD	° incremental effects on air quality - extremely small
					0		1E	° although incremental effects small, existence of polluting industries in vicinity of site a potential constraint on future operations of OWMC should an airshed management program be introduced in the affected area

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking
7 - Preference
ND - No Difference
LD - Limiting Difference

There are, however, a number of arguments for attaching particular importance to the industrial designation of PI-27E, including the following:

- The industrial designation represents a statement of policy on behalf of the local and regional municipalities regarding the future disposition of lands at site PI-27E. It is desirable for OWMC to establish its facilities in locations where the land use policies are consistent with the nature of the OWMC facilities. The characteristics of the OWMC facilities are, in many respects, comparable to those of industrial facilities.

- With the industrial official plan designation, the public in general, and the residents and businesses on and in the vicinity of PI-27E, are likely to have the expectation of industrial development on the site. The uses and features displaced or affected by the OWMC facility may be displaced or directly affected by industrial development in any event. Such expectations are not present at LF-1E. LF-1E is designated for agricultural uses.

- The City of Niagara Falls has a large and long-term supply of industrial land. Industries which might have been established at the PI-27E site, therefore, have the opportunity of locating at a range of other industrial locations within Niagara Falls. OWMC does not have a similar range of choices. PI-27E is the only industrially designated candidate site.

- The development of the OWMC industrial-type facility (the incinerator and the physical/chemical treatment plant) at LF-1E would necessitate the extension of urban services to the site. The establishment of the OWMC facility at LF-1E, together with the service extensions to the site, represent both a precedent and an incentive for the establishment of further industrial uses beyond the urban area boundary of Niagara Falls. Such forms of development can be prevented through land use controls. However, in the event that they occur, the cumulative effects of development by OWMC of LF-1E, together with other non-agricultural uses in the same area as existing farming operations, residents and businesses, could be greater than the cumulative effects associated with the development of the LF-1E/PI-27E siting option.

- As there is a plentiful supply of industrial land within Niagara Falls, the development of the PI-27E site by OWMC should not adversely affect the industrial land supply of the City. The service extensions to PI-27E could represent an incentive for the more rapid development of industrial land within the area.

In the final analysis, the arguments in favour of attaching particular importance to the industrial designation of PI-27E are more persuasive. This conclusion has the following implications for the interpretation of potential socio-economic and biological impacts:

- it reinforces the preference for LF-1E/PI-27E from an agricultural perspective;

- it narrows the social gap between the two options. It means, for example, that the displacement of residents and the disruption of the daily activities of residents and community and recreation features adjacent and in the site vicinity of LF-1E are more important than would be the case with PI-27E. As indicated in Table 6.17, the two options are already highly ranked in terms of adjacent residents and residents in the site vicinity. In addition, it means the social cohesion and social stability differences between the two options are diminished. These differences in interpretation represent a qualitative adjustment based on the industrial designation of PI-27E;

- it narrows the biological gap between LF-1E and LF-1E/PI-27E. If the assumption is made that PI-27E will be developed for industrial use, with or without the OWMC facility, many of the biological displacement and proximity effects identified as occurring as a consequence of site development at PI-27E may occur in any event. As few industrial uses have the buffer areas associated with the OWMC facilities, industrial development at PI-27E could result in more severe biological impacts than would be the case with the OWMC facility. This, of course, depends on the type and extent of industrial development. There are no policies in either the regional or local official plans which preclude or restrict industrial development at PI-27E based on biological concerns. Although biological constraints have been identified at PI-27E, they are not severe in an absolute sense;

- it reinforces the land use preference for LF-1E/PI-27E.

The net effect of attaching particular importance to the industrial designation of PI-27E is to shift the overall socio-economic preference from LF-1E to LF-1E/PI-27E. The limited economic base and municipal finance differences (favouring LF-1E) do not offset the overall preference for LF-1E/PI-27E. The clear preference for LF-1E by the air quality consultant is based on existing pollutant level differences and is also not sufficient to outweigh the overall preference for LF-1E/PI-27E. This conclusion stems from the very small contribution made by the OWMC facility to air quality changes in the area. It is also a consequence of the expectation that the emissions from the OWMC facility will represent a small fraction of corresponding standards and guidelines - less than 1% for most contaminants (ORF, 1985, p.64).

(b) LF-1E versus LF-9C

The comparison between LF-1E and LF-9C involves some difficult tradeoffs. LF-1E is preferred by the agriculture, social and land use consultants. LF-9C is preferred by the economic base, municipal finance, biology and air impact consultants. The differences between the options are highlighted in Table 6.18. The major reasons for the preference for LF-1E are highlighted below:

- there are major agriculture and social differences and clear land use differences favouring LF-1E;
- the business economic base impact differences favouring LF-9C are minor. Impact for both options are slightly positive. When the agricultural, tourism and business economic impacts were combined by the economic consultant, there was a clear preference for LF-9C. The basis for this difference is major tourism impact potential differences and moderate agricultural economic impact differences. These differences may be limited as:
  - the potential tourism impacts (as interpreted by the social consultant) are expected to be minor and short-term;[1]
  - the analysis is dependent on the weights attached to the agricultural, tourism and business components of the economy;
  - depending on the definition of the site vicinity study area, the business impact preference strongly favours LF-1E; if the Ford Motor Company Glass Plant, Cyanamid and B.F. Goodrich are included in the study area, the gap between the options for overall economic base impacts is closed and possibly reversed in favour of LF-1E.
- the municipal finance and biological impact differences favouring LF-9C are both clear but moderate. The biological factors are not as highly ranked as the most highly ranked agriculture, social and land use factors. For municipal finance impacts:

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[1] One of the tourism subconsultants (Laventhol and Horwath) indicated that, "Selecting either of the options involving the Niagara Falls sites, from a tourism perspective, could hold potentially serious implications" (IER, 1985e, p.152).

TABLE 6.18

Summary Arguments - Impact Rankings - LF-1E versus LF-9C

DISCIPLINE	CRITERIA						7	REASONS/COMMENTS
	1	2	3	4	5	6		
Agriculture		0					1E	° LF-1E and LF-9C are ranked second and fourth, respectively; major difference between options
		0					1E	° greater displacement impacts (farms and farmland) with LF-1E more than offset by much greater site vicinity, community and regional and access road impacts with LF-9C
		0					1E	° with LF-1E, site in unstable agricultural area - many small scale hobby farms and non-agricultural activities; LF-9C in the midst of a stable agricultural community (Ecologistics, 1985, p.164)
Social		0					1E	° LF-1E and LF-9C are ranked first and third, respectively
		0					1E	° major difference between options
		0					9C	° IER numerical analysis - preference for LF-9C
		0					1E	° displacement of residents, disruption of community and recreation features and social stability and social cohesion preference for LF-9C more than offset by preference for LF-1E for disruption of residential uses - adjacent and site vicinity, access road impacts and community character concerns
		0					1E	° qualitative analysis - reinforces preference for LF-1E - emphasizes potential community character and social cohesion effects in a stable agricultural area (LF-9C) as compared with the non-agricultural nature of area (LF-1E)

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking
7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.18

Summary Arguments - Impact Rankings - LF-1E versus LF-9C

DISCIPLINE	CRITERIA						7	REASONS/COMMENTS
	1	2	3	4	5	6		
Social (continued)							LD	° conclusion of IER that any impact on the community image of Niagara Falls regarding tourism will be minimal and short-term (IER, 1985a, p.308)
							9C	° one of tourism consultants (Laventhol and Horwath) concluded that, "Selection of either of the options involving the Niagara Falls sites, from a tourism perspective, could hold potentially serious implications. As our analysis of potential Niagara Falls-based impacts (see Section V), it is our judgement that a decline in the level of tourist visitation could well occur. In addition, the investment climate and future development potential of an important Canadian tourism resource could be adversely affected by the selection of either LF-1E and/or PI-27E for the OWMC facility" (IER, 1985e, p.152)
Land Use		0					1E	° LF-1E and LF-9C are ranked second and third, respectively
		0					1E	° displacement and, to a lesser extent, site vicinity constraints associated with LF-1E more than offset by community and regional and access road advantages
		0					1E	° clear difference favouring LF-1E; land use report emphasizes the lower level of land use stability in the vicinity of LF-1E, the proximity of the site to existing and future industrial areas and the excellent accessibility to LF-1E/PI-27E; contrasted with potential access road impacts (especially through Vineland area) and agricultural character of the West Lincoln sites (LKA, 1985, p.137)

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking
7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.18

Summary Arguments - Impact Rankings - LF-1E versus LF-9C

DISCIPLINE	CRITERIA							REASONS/COMMENTS
	1	2	3	4	5	6	7	
Economic Base		0					9C	° LF-9C and LF-1E are ranked first and second, respectively, for economic base impacts
		0					LD	° minor differences between options - both slightly positive
		0					1E	° greater positive impacts on community and regional economic base with LF-1E more than offset by more displacement of business activity, more property value impacts and greater negative impacts on business activity
		0					1E	° if site vicinity study area redefined to include major businesses just beyond study area boundary (2 km) (i.e. Ford Motor Company Glass Plant, Cyanamid Inc. and B.F. Goodrich), the estimated positive economic base impacts would be "...relatively large for LF-1E and it would become the most preferred siting option for economic base impacts by a wide margin" (Clayton, 1985a, p.108)
		0 0					1E 9C	° when economic base, agriculture and tourism economic impacts combined - clear preference for LF-9C; moderate agriculture economic preference for LF-1E more than offset by major tourism and slight business impact differences favouring LF-9C
		0					LD	° conclusion dependent on relative weight placed on business, agriculture and tourism components of the economy and expectations re. tourism and agricultural economic impacts

Legend:

1 - Absolute Risk and Impacts	4 - Uncertainty	7 - Preference
2 - Relative Risk and Impacts	5 - Policy	ND - No Difference
3 - Mitigation	6 - Factor Ranking	LD - Limiting Difference

TABLE 6.18

Summary Arguments - Impact Rankings - LF-1E versus LF-9C

DISCIPLINE	CRITERIA 1	2	3	4	5	6	7	REASONS/COMMENTS
Municipal Finance		0					9C	° LF-9C and LF-1E are ranked first and third, respectively
							9C	° moderate differences between options; impacts positive for both options
							9C	° major positive features for LF-9C are a large positive impact from payment-in-lieu of taxes, lower operating cost impacts on services (because of lower levels of service) and lower negative property value impacts (because of fewer affected households and lower taxes); with LF-1E, a much lower increase in regional municipal revenues (because of the lower regional mill rate in Niagara Falls), high area municipal operating costs (because of the higher level of area municipal servicing) and lower relative positive impact on area municipal tax rates (because of the larger size of the municipal tax base in Niagara Falls) (Clayton, 1985b, pp.90-93)
		0					LD	° qualitative considerations tend to close the gap between the two options: - West Lincoln: concerns of Township whether OWMC will bear all municipal capital works associated with facility and regarding incremental costs, e.g. permanent rather than volunteer fire department, need for additional services such as planning and engineering
						0	LD	° municipal finance - moderately ranked factor (level 6)
			0		0		LD	° OWMC commitment that no municipality will suffer financially

Legend:

1 - Absolute Risk and Impacts	4 - Uncertainty	7 - Preference
2 - Relative Risk and Impacts	5 - Policy	ND - No Difference
3 - Mitigation	6 - Factor Ranking	LD - Limiting Difference

TABLE 6.18

Summary Arguments - Impact Rankings - LF-1E versus LF-9C

DISCIPLINE	CRITERIA							REASONS/COMMENTS
	1	2	3	4	5	6	7	
Municipal Finance (continued)	0		0				LD	° in absolute terms, adverse municipal finance impacts expected to be limited; negative impacts on operating costs are offset by revenue increases
			0				LD	° net adverse municipal finance impacts to the extent that they occur, are mitigable
Biology		0					9C	° LF-9C and LF-1E are ranked as second and fifth, respectively
		0					LD	° differences between options clear but moderate
		0					9C	° greater on site impacts with LF-1E (potential for occurrence of significant features and natural vegetation displacement) and greater site vicinity impacts; partially offset by preference for LF-1E - rare species on site and potential access road impact on fish communities
Air		0					9C	° LF-9C and LF-1E are ranked first and third, respectively
		0					9C	° moderate difference between options
		0					9C	° no difference - restraints to dispersion; moderate difference favouring LF-9C - existing and anticipated air quality
						0	LD	° air impact factors - moderately ranked (levels 6 and 2)

Legend:

1 - Absolute Risk and Impacts	4 - Uncertainty	7 - Preference
2 - Relative Risk and Impacts	5 - Policy	ND - No Difference
3 - Mitigation	6 - Factor Ranking	LD - Limiting Difference

TABLE 6.18

Summary Arguments - Impact Rankings - LF-1E versus LF-9C

DISCIPLINE	CRITERIA 1	2	3	4	5	6	7	REASONS/COMMENTS
Air (continued)	0		0			0	LD	° minimal air dispersion constraints (sites with significant constraints avoided at an earlier stage); to the extent that constraints exist, mitigable
	0				0		LD	° air quality - facility emissions well within applicable standards and guidelines - 1% or less for the incinerator stack emissions and 10% or less for fugitive emissions (ORF, 1985, p.64)
	0						LD	° incremental effects on air quality - extremely small, although incremental effects small, existence of polluting industries in vicinity of site considered a potential constraint on future operations of OWMC should an airshed management program be introduced in the affected area

Legend:

1 - Absolute Risk and Impacts	4 - Uncertainty	7 - Preference
2 - Relative Risk and Impacts	5 - Policy	ND - No Difference
3 - Mitigation	6 - Factor Ranking	LD - Limiting Difference

- impacts are positive for both siting options;
- the gap between the options is narrowed by qualitative considerations, e.g. greater incremental costs in rural area with limited range of services;
- any adverse effects are mitigable; there is an OWMC commitment to mitigate;
- municipal finance is a moderately ranked factor.

- the air impact differences between the options are moderate. Potential air impacts are not ranked as highly as the more highly ranked social, agricultural and land use factors. These differences reflect the likelihood that mitigation will not be required and the small absolute levels of impact anticipated.

Overall, the social, agriculture and land use differences (favouring LF-1E) more than offset the more limited economic base, municipal finance, biological and air impact differences favouring LF-9C. This preference is reinforced by differences in factor rankings, mitigation potential and absolute levels of impacts.

(c) LF-1E/PI-27E versus LF-9C

The final tier one comparison between LF-1E/PI-27E and LF-9C also involves some very difficult tradeoffs. As with the LF-1E versus LF-1E/PI-27E comparison, the overall conclusion is dependent on the importance attached to the industrial designation of PI-27E. The tradeoffs among consultants involve the agriculture, social and land use consultants favouring LF-1E/PI-27E, and the economic base, municipal finance, biology and air consultants favouring LF-9C. The differences between the options are highlighted in Table 6.19. LF-1E/PI-27E is preferred to LF-9C for the reasons cited below:

TABLE 6.19

Summary Arguments - Impact Rankings - LF-1E/PI-27E versus LF-9C

DISCIPLINE	CRITERIA							REASONS/COMMENTS
	1	2	3	4	5	6	7	
Agriculture		0					1E/27E	° LF-1E/PI-27E and LF-9C are ranked first and fourth, respectively
		0					1E/27E	° major differences between options
		0 0					9C 1E/27E	° lower displacement of farms with LF-9C more than offset by greater loss of farmland, and greater site vicinity, community and regional and access road impacts favouring LF-1E/PI-27E
Social		0					1E/27E	° LF-1E/PI-27E and LF-9C are ranked second and third, respectively
		0					1E/27E	° IER numerical analysis - preference for LF-9C (resident displacement, community and recreation features adjacent and site vicinity, social stability and cohesion) more than offset by preference for LF-1E/PI-27E (residents - adjacent and site vicinity, access road impacts and community character differences)
		0					1E/27E	° qualitative analysis reinforces preference for LF-1E/PI-27E - emphasizes potential community character and social cohesion effects in a stable agricultural area (LF-9C) as compared with non-agricultural nature of area with a significant component of heavy industry (LF-1E/PI-27E)
		0					LD	° conclusion of IER that community image of Niagara Falls, regarding tourism, would not be seriously affected by OWMC facility - major reasons: comparative study did not identify any impacts, the Laventhol and Horwath projection of tourism decline is short-lived; Niagara Falls is an international tourist attraction; the potential

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation

4 - Uncertainty
5 - Policy
6 - Factor Ranking

7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.19

Summary Arguments - Impact Rankings - LF-1E/PI-27E versus LF-9C

DISCIPLINE	CRITERIA							REASONS/COMMENTS
	1	2	3	4	5	6	7	
Social (continued)								sites are about 5.5 km (PI-27E) and 8 km (LF-1E) from the Horseshoe Falls; Niagara Falls and the Niagara Region are home to many heavy industries and have been so for a number of decades; the PI-27E site is designated for industry and is adjacent to industry (IER, 1985a, p.308)
							9C	° one of the tourism consultants (Laventhol and Horwath) concluded that, "Selection of either of the options involving the Niagara Falls sites, from a tourist perspective, could hold potentially serious implications" (IER, 1985e, p.152)
Land Use		0					1E/27E	° LF-1E/PI-27E and LF-9C are ranked first and third, respectively
		0					1E/27E	° clear difference favouring LF-1E/PI-27E
							9C	° lower on-site impacts with LF-9C more than offset by site vicinity (slight differences), community and regional and access road impacts
		0			0		1E/27E	° in reaching conclusion, land use analysis focuses on the industrial designation of PI-27E, the proximity to industrial uses, the direct access to the QEW, and the lower level of land use stability
Economic Base		0					9C	° LF-9C and LF-1E/PI-27E are ranked first and third, respectively, for business impacts
		0					LD	° differences between options minor - both options slightly positive for business economic impacts

Legend:

1 - Absolute Risk and Impacts	4 - Uncertainty	7 - Preference
2 - Relative Risk and Impacts	5 - Policy	ND - No Difference
3 - Mitigation	6 - Factor Ranking	LD - Limiting Difference

TABLE 6.19

Summary Arguments - Impact Rankings - LF-1E/PI-27E versus LF-9C

DISCIPLINE	CRITERIA						7	REASONS/COMMENTS
	1	2	3	4	5	6		
Economic Base (continued)		0					9C	° greater displacement of business activity, adverse property value impacts, negative business activity impacts with LF-1E/PI-27E; limitations of LF-1E/PI-27E largely offset by positive business impacts and positive impacts on community and regional economic base; when economic base, agriculture and tourism economic impacts combined - clear preference for LF-9C; major tourism impact differences more than offset by moderate agriculture and minor business economic differences
		0					LD	° conclusion dependent on relative weight placed on business, agriculture and tourism components of the economy and expectations re. tourism and agricultural economic impacts
Municipal Finance		0					9C	° LF-9C and LF-1E/PI-27E are ranked first and fourth, respectively
		0					9C	° clear differences between options
		0					LD	° impacts positive for both options
		0					9C	° major positive features for LF-9C are a large positive impact from payment-in-lieu of taxes, lower operating cost impacts on services (because of fewer affected households and lower taxes); with LF-1E/PI-27E much lower increase in regional municipal revenues (because of the lower regional mill rate in Niagara Falls), high area municipal operating costs (because of the higher level of area municipal servicing) and lower relative positive impact on area municipal tax rates

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation

4 - Uncertainty
5 - Policy
6 - Factor Ranking

7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.19

Summary Arguments - Impact Rankings - LF-1E/PI-27E versus LF-9C

DISCIPLINE	CRITERIA 1	2	3	4	5	6	7	REASONS/COMMENTS
Municipal Finance (continued)								(because of the larger size of the municipal tax base in Niagara Falls) (Clayton, 1985b, pp.90-93)
		0					9C	° with one site - less reduction in property taxes due to negative property impacts
		0					LD	° qualitative considerations close the gap between the two options: - West Lincoln: concern of Township whether OWMC will bear all municipal capital works costs associated with facility and regarding incremental costs, e.g. permanent rather than volunteer fire department, need for additional services such as planning and engineering
						0	LD	° municipal finance - moderately ranked factor (level 6)
					0		LD	° OWMC commitment that no municipality will suffer financially
	0		0				LD	° in absolute terms, adverse municipal finance impacts expected to be limited; negative impacts on operating costs are offset by revenue increases
			0				LD	° net adverse municipal finance impacts, to the extent that they occur, are mitigable
Biology		0					9C	° LF-9C and LF-1E/PI-27E are ranked as second and sixth, respectively

Legend:

1 - Absolute Risk and Impacts	4 - Uncertainty	7 - Preference
2 - Relative Risk and Impacts	5 - Policy	ND - No Difference
3 - Mitigation	6 - Factor Ranking	LD - Limiting Difference

TABLE 6.19

Summary Arguments - Impact Rankings - LF-1E/PI-27E versus LF-9C

DISCIPLINE	CRITERIA							REASONS/COMMENTS
	1	2	3	4	5	6	7	
Biology (continued)		0					9C	° more than moderate differences between options; much greater on-site and site vicinity biological impacts
		0					1E/27E	° greater potential impact on fish communities along access roads with LF-9C
		0					LD	° industrial designation of PI-27E not considered in the interpretation of potential biological impacts
Air		0					9C	° LF-9C and LF-1E/PI-27E are ranked first and sixth, respectively
		0					9C	° major differences between options
		0					9C	° no difference - restraints to dispersion; major differences favouring LF-9C - existing and anticipated air quality
							LD	° air impact factors - moderately ranked (levels 6 and 2)
	0					0	LD	° air quality - facility emissions well within applicable standards and guidelines - 1% or less for the incinerator stack emissions and 10% or less for fugitive emissions (ORF, 1985, p.64)
	0				0		LD 9C	° incremental effects on air quality - extremely small, although incremental effects small, existence of polluting industries in vicinity of LF-1E/PI-27E a potential constraint to future operations of OWMC should an airshed management program be introduced into the affected area

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation

4 - Uncertainty
5 - Policy
6 - Factor Ranking

7 - Preference
ND - No Difference
LD - Limiting Difference

- there are major agricultural and clear social and land use differences favouring LF-1E/PI-27E;

- the business economic base impact differences favouring LF-9C are minor. Impacts for both options are slightly positive. When the agricultural, tourism and business economic impacts were combined by the economic consultant (see Appendix E), there was a clear preference for LF-9C. The basis for this difference are major tourism impact potential differences and moderate agricultural economic impact differences. These differences may be limited because:

  - the tourism impacts (as interpreted by the social consultant) are expected to be minor and short-term[1];

  - analysis is dependent on the weights attached to the agricultural, tourism and business components of the economy;

- the municipal finance differences favouring LF-9C are moderate. Impacts are positive with both options. The gap between the options is narrowed based on qualitative considerations, e.g. greater incremental costs in rural municipality with limited range of services. Any adverse effects are mitigable. There is an OWMC commitment to mitigate OWMC-related municipal financial impacts. Municipal finance is a moderately ranked factor;

- there is clear biological preference for LF-9C. The significance of the biological impact difference is tempered somewhat by the designation of PI-27E for industrial development. There is no public policy commitment to preserving biological resources on either of the

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[1] One of the tourist consultants (Laventhol and Horwath) concluded that, "Selection of either of the options involving the Niagara Falls sites, from a tourism perspective, could hold potentially serious implications" (IER, 1985e, p.152).

Niagara Falls sites. Thus, industrial development at PI-27E could potentially have comparable on and off-site biological impacts to those associated with the OWMC facilities. The biological factors are not generally ranked as highly as the most highly ranked social, land use and agricultural factors;

- there is a clear air impact preference for LF-9C. The significance of this preference is tempered somewhat by the small incremental effects of the OWMC facility and by the moderate ranking of the air impact factors;

- as with the LF-1E/PI-27E versus LF-1E comparison, particular importance is attached to the industrial designation of PI-27E. The major reasons for this position include:

    - consistency with local and regional municipal land use policies;

    - possible expectation on the part of local residents and businesses of industrial development at PI-27E;

    - potential development implications associated with service extensions to LF-1E and as a result of the precedent of establishing an industrial-type use beyond the urban area boundary of Niagara Falls (although such forms of development can be controlled).

- a qualitative adjustment placing greater weight on the importance of the industrial designation at PI-27E has the following implications for the LF-9C vs. LF-1E/PI-27E comparison:

    - it reinforces the agriculture, land use and social preferences for LF-1E/PI-27E;

    - it narrows the gap between the options in terms of biological impacts (expectation of industrial development at PI-27E in the future).

- the more highly ranked factors (agriculture, social, land use) favour LF-1E/PI-27E; the more moderately ranked factors (biology, air, municipal finance) favour LF-9C; these factor ranking differences are also reflected in the lower potential absolute agricultural, social and land use impacts, the lower absolute air impact and the greater municipal financial mitigation potential associated with the disciplines favouring LF-9C.

In summary, the agriculture, social and land use preferences for LF-1E/PI-27E outweigh the biological, air, municipal finance and economic base preferences for LF-9C. The arguments in favour of LF-1E/PI-27E are reinforced by magnitude of impact, factor ranking, absolute impact and mitigation potential differences. They are further reinforced by the qualitative adjustment which attaches particular importance to the industrial designation of PI-27E.

(d) Ranking of Tier One Options

On the basis of the preceding analyses, the tier one options are ranked, from an impact perspective, as follows:

1. LF-1E/PI-27E;
2. LF-1E;
3. LF-9C.

6.4.5 COMPARISON OF BOTTOM RANKED OPTION - TIER ONE (LF-9C) WITH TOP RANKED OPTION - TIER TWO (LF-4N/PI-1N AND LF-3C)

The final step in the impact ranking of siting options is the comparison of the option ranked third among the Tier one options (LF-9C) with the options ranked first among the Tier two options (LF-4N/PI-1N and LF-3C). These comparisons confirm the division between the Tier one and Tier two option groupings.

(a) Comparison of LF-9C and LF-4N/PI-1N

LF-9C is preferred to LF-4N/PI-1N by the social, the land use, economic base, municipal finance and the air impact consultants. The only consultants who rank LF-4N/PI-1N higher than LF-9C are the agricultural and biology consultants. The differences between the options are highlighted in Table 6.20. For the reasons cited below, LF-9C is preferred:

- there are clear land use, economic base, social and air impact preferences for LF-9C;
- there are strong economic base, municipal finance and air impact preferences for LF-9C;
- the agricultural and biological preferences for LF-9C over LF-4N/PI-1N are slight;
- factor ranking, mitigation potential and absolute level of impact considerations do not alter the overall preference for LF-9C.

(b) Comparison of LF-9C and LF-3C

LF-9C is preferred to LF-3C by the agriculture, social, land use, economic base, municipal finance and biology consultants. LF-3C and LF-9C are ranked at the same level by the air impact consultant. As LF-3C is not ranked more highly than LF-9C by any of the impact consultants, the only argument for altering the siting option rankings would be if the differences between the options are essentially negligible. If such were the case, the two options would be ranked at the same level.

The differences between the options are highlighted in Table 6.21. As indicated in Table 6.21, there are clear agricultural, social, land use, economic base and biology (to a lesser extent) differences between the two options all favouring LF-9C.

TABLE 6.20

Summary Arguments - Impact Rankings - LF-4N/PI-1N versus LF-9C

DISCIPLINE	CRITERIA 1	2	3	4	5	6	7	REASONS/COMMENTS
Agriculture		0					4N/1N	° LF-4N/PI-1N and LF-9C are ranked third and fourth, respectively
		0					LD	° agricultural report points out, "...LF-4N/PI-1N slightly better siting option than LF-9C" (Ecologistics, 1985, p.162)
		0					4N/1N	° LF-9C - higher vicinity and community and regional impacts
		0					9C	° LF-4N/PI-1N - higher on site and access road (farm traffic and cattle crossing) impacts
Social		0					9C	° LF-9C and LF-4N/PI-1N are ranked third and fourth, respectively
		0					9C	° clear difference based on IER numerical analysis
		0					LD	° gap closed somewhat by qualitative adjustments - emphasizes potential community character and social cohesion
		0					9C	° residential displacement, adjacent and site vicinity impacts - residents and community and recreation features, access route vicinity - residents and access routes - community and recreation features and social cohesion and community character - LF-9C is favoured
		0					4N/1N	° LF-4N/PI-1N is favoured - adjacent access route - residents and social stability
		0					4N/1N	° with qualitative adjustments - community character rankings reversed

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking
7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.20

Summary Arguments - Impact Rankings - LF-4N/PI-1N versus LF-9C

DISCIPLINE	CRITERIA						7	REASONS/COMMENTS
	1	2	3	4	5	6		
Land Use		0					9C	° LF-9C and LF-4N/PI-1N are ranked third and fourth, respectively
		0					9C	° clear difference favouring LF-9C
		0					9C	° with LF-9C, lower on and off-site impacts on residents, lower potential for impacts in community and regional study area, existing and future residential uses, no conflict with provincial planning policies
							4N/1N	° preferred - residences along access routes and in the lower level of land use stability in the Milton area (LKA, pp.137-138)
Economic Base		0					9C	° LF-9C and LF-4N/PI-1N are ranked first and fifth, respectively
		0					9C	° major difference between options
		0					9C	° when business, agriculture and tourism economic impacts are combined, major difference maintained
		0					9C	° with business impacts - LF-9C - much less displacement of business activity, negative property value impacts and negative business impacts
		0					4N/1N	° moderate differences favouring LF-4N/PI-1N - positive business impacts and positive community and regional economic base impacts
		0					4N/1N	° agricultural economic impacts - moderate difference - favouring LF-4N/PI-1N

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation

4 - Uncertainty
5 - Policy
6 - Factor Ranking

7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.20

Summary Arguments - Impact Rankings - LF-4N/PI-1N versus LF-9C

DISCIPLINE	CRITERIA 1	2	3	4	5	6	7	REASONS/COMMENTS
Economic Base (continued)		0					9C	° tourism economic impacts - moderate difference - favouring LF-9C
Municipal Finance		0					9C	° LF-9C and LF-4N/PI-1N are ranked first and fifth, respectively
		0					9C	° with LF-9C - large positive impacts because small municipal tax base, lower levels of service and lower potential property value impacts; with LF-4N/PI-1N much fewer positive impacts - payment-in-lieu of taxes (because of unusual tax levy situation), greater negative property value impacts, reduced property taxes with two sites
		0					9C	° Milton: municipal officials raised concerns re. assimilation capacity of sewage treatment plant, incremental costs, e.g. fire department, staffing, staff time for inquiries, capital works projects ° West Lincoln: concern of Township whether OWMC will bear all municipal capital works with facility; concern re. incremental costs, e.g. permanent rather than volunteer fire department, need for additional services such as planning and engineering
						0	LD	° municipal finance - moderately ranked factor (level 4)
					0		LD	° OWMC commitment that no municipality will suffer financially

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation

4 - Uncertainty
5 - Policy
6 - Factor Ranking

7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.20

Summary Arguments - Impact Rankings - LF-4N/PI-1N versus LF-9C

DISCIPLINE	CRITERIA							REASONS/COMMENTS
	1	2	3	4	5	6	7	
Municipal Finance (continued)	0						LD	° in absolute terms, adverse municipal finance impacts limited; negative impacts on operating costs are offset by revenue increases
			0				LD	° adverse municipal finance impacts are mitigable
		0					9C	° if Region of Halton selects PI-1N as regional landfill site - LF-4N/PI-1N ranked sixth
Biology							4N/1N	° LF-4N/PI-1N and LF-9C are ranked first and second, respectively
							LD	° little overall difference between options; both options in Group A
Air		0					9C	° LF-9C and LF-4N/PI-1N are ranked first and fifth, respectively
		0					9C	° major differences - restraints to dispersion and moderate differences - existing and anticipated air quality - both favouring LF-9C
		0					9C	° clear difference between options
						0	LD	° air impact factors - moderately ranked (levels 6 and 2)
	0		0				LD	° minimal air dispersion constraints (sites with significant constraints) avoided at an earlier stage; to the extent that constraints exist, mitigable

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking
7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.20

Summary Arguments - Impact Rankings - LF-4N/PI-1N versus LF-9C

DISCIPLINE	CRITERIA 1	2	3	4	5	6	7	REASONS/COMMENTS
Air (continued)					0		LD	• air quality - facility emissions - well within applicable standards and guidelines - 1% or less for the incinerator stack emissions and 10% or less for fugitive emissions (ORF, 1985, p.64)
	0						LD	• incremental effects on air quality - extremely small

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking
7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.21

Summary Arguments - Impact Rankings - LF-9C versus LF-3C

DISCIPLINE	CRITERIA							REASONS/COMMENTS
	1	2	3	4	5	6	7	
Agriculture		0					9C	° LF-9C and LF-3C are ranked fourth and sixth, respectively
							9C	° clear difference between options based on qualitative and quantitative analysis
Social		0					9C	° LF-9C and LF-3C are ranked third and sixth, respectively
		0					9C	° clear to major difference between options based on IER numerical analysis
		0					9C	° difference between options not altered by qualitative adjustments
Land Use		0					9C	° LF-9C and LF-3C are ranked third and fourth, respectively
		0					9C	° clear difference between options - LF-9C preferred for site, site vicinity and access road impacts on residents (LKA, 1985, p.137)
Economic Base		0					9C	° LF-9C and LF-3C are ranked first and fourth, respectively
		0					9C	° clear difference - business impacts
		0					9C	° major difference when business, tourism and agricultural economic impacts combined
Municipal Finance		0					9C	° LF-9C and LF-3C are ranked first and second, respectively

Legend:

1 - Absolute Risk and Impacts
2 - Relative Risk and Impacts
3 - Mitigation
4 - Uncertainty
5 - Policy
6 - Factor Ranking
7 - Preference
ND - No Difference
LD - Limiting Difference

TABLE 6.21

Summary Arguments - Impact Rankings - LF-9C versus LF-3C

DISCIPLINE	CRITERIA							REASONS/COMMENTS
	1	2	3	4	5	6	7	
Municipal Finance (continued)		0					LD	° slight difference between options; greater road maintenance costs
Biology		0					9C	° LF-9C and LF-3C are ranked second and fourth, respectively
		0					9C	° moderate differences between options
Air		0					ND	° LF-9C and LF-3C are ranked at same level

Legend:

1 - Absolute Risk and Impacts	4 - Uncertainty	7 - Preference
2 - Relative Risk and Impacts	5 - Policy	ND - No Difference
3 - Mitigation	6 - Factor Ranking	LD - Limiting Difference

6.4.6 OVERALL IMPACT RANKING

On the basis of the preceding analysis, the six siting options are ranked as follows:

1. LF-1E/PI-27E;
2. LF-1E;
3. LF-9C;
4. LF-4N/PI-1N and LF-3C;
6. LF-4N/PI-13N.

The following is concluded from the preceding analyses:

- there is a wide gap between the fourth (LF-4N/PI-1N and LF-3C) and sixth (LF-4N/PI-13N) ranked options;
- there is quite a wide gap between the third (LF-9C) and fourth (LF-4N/PI-1N and LF-3C) ranked options;
- the differences among the top ranked options are moderate; the rankings involve some difficult interpretations and tradeoffs;
- the differences among the top ranked options are dependent on the relative importance attached to the industrial designation of PI-27E.

6.5 COMBINING RISK AND IMPACT RANKINGS

6.5.1 INTRODUCTION

Table 6.22 highlights the overall risk and impact rankings of the six siting options as detailed in Section 6.4 of this chapter. In this section, these rankings are combined. The process of combining risk and impact rankings involves the following steps:

1. identification of tiers of options (if possible);
2. identification of consistent risk and impact rankings;
3. identification of tradeoffs within Tier Two;
4. identification of tradeoffs within Tier One.

Risks are ranked higher by OWMC than impacts. A major impact(s) or impact difference may, however, offset a small risk or risk difference. The risk and impact integration process involves the consideration of:

- the absolute levels of risk and impacts;
- differences among options;
- the potential for mitigation;
- uncertainties in risk and impact prediction and the implications of these uncertainties;
- risk and impact policy implications.

TABLE 6.22
Overall Risk and Impact Rankings

RANKINGS	RISK	IMPACTS
1	LF-9C	LF-1E/PI-27E
2	LF-1E	LF-1E
3	LF-3C and LF-1E/PI-27E	LF-9C
4	-	LF-4N/PI-1N and LF-3C
5	LF-4N/PI-1N	-
6	LF-4N/PI-13N	LF-4N/PI-13N

6.5.2 IDENTIFICATION OF TIERS OF OPTIONS

As occurs in the impact rankings, the six options fall readily into two groupings. LF-9C, LF-1E and LF-1E/PI-27E are ranked no lower than third for both risks and impacts. LF-4N/PI-1N and LF-4N/PI-13N are ranked no higher than fourth. LF-3C is ranked fourth for impacts and third (together with LF-1E/PI-27E) for risks. LF-3C is ranked lower than LF-9C and LF-1E for both risks and impacts. LF-3C is ranked lower than LF-1E/PI-27E when risks and impacts are combined, because it is ranked at the same level as LF-1E/PI-27E for risks and much lower than LF-1E/PI-27E for impacts.

In view of the above, the siting options have been placed into two tiers for the purpose of combining risk and impact rankings:

- Tier 1 - composed of LF-9C, LF-1E and LF-1E/PI-27E;
- Tier 2 - composed of LF-3C, LF-4N/PI-1N and LF-4N/PI-13N.

6.5.3 IDENTIFICATION OF CONSISTENT RISK AND IMPACT RANKINGS

The only options ranked at the same level in both the overall risk the overall impact rankings are LF-4N/PI-13N and LF-1E. LF-4N/PI-13N is ranked sixth for both risks and impacts. These relative risk/impact rankings reinforce the hydrogeologic analysis which concludes that LF-4N/PI-13N fails the basic acceptability screen. LF-1E is ranked second for both risks and impacts.

6.5.4 TRADEOFFS WITHIN TIER TWO

The only tradeoff in Tier Two is between LF-3C and LF-4N/PI-1N. LF-3C is ranked third for risks and fourth for impacts. LF-4N/PI-1N is ranked fifth for risks and fourth for impacts. In view of the higher ranking of LF-3C for risk, there is a clear preference for LF-3C over LF-4N/PI-1N. LF-4N/PI-1N would only be preferred over LF-3C in the event that:

- the absolute levels of risks for both siting options are low;
- the risk differences are limited;
- there is a reasonable expectation that the risks associated with LF-4N/PI-1N are mitigable;
- there is a high level of confidence in the risks prediction and the likelihood of implementation of effective mitigative measures;
- the selection of LF-4N/PI-1N does not have adverse risk policy-related implications for OWMC.

Table D.3 in Appendix D details the risk tradeoffs between LF-3C and LF-4N/PI-1N. It addresses absolute levels of risk, relative risk differences, mitigation potential, uncertainty and policy implications. On the basis of a review of the tradeoffs cited in Table D.3, LF-3C is preferred to LF-4N/PI-1N. The major reasons for this preference includes the following:

- because of the short breakthrough times and the uncertainties regarding sand layers, leachate quality and long-term mitigation, absolute hydrogeologic risks at LF-4N/PI-1N are not necessarily low;
- the hydrogeologic and, to a lesser extent, air differences between the two options are more than limited (the preference for LF-3C widens when

the alternative weighting scheme, which places greater weight on direct air emissions, is employed); this difference more than offsets the surface water and transportation risk differences favouring LF-4N/PI-1N. The risk differences between the two options are not limited;

- o hydrogeologic risks at LF-4N/PI-1N are not necessarily mitigable in the long-term; mitigation potential reinforces the preference for LF-3C;

- o there is not necessarily a high degree of certainty regarding the prediction of hydrogeologic risk for LF-4N/PI-1N or for the effectiveness of mitigative measures;

- o the marginal hydrogeologic suitability of LF-4N/PI-1N raises questions of consistency with the OWMC policy of ensuring a second level of protection through natural containment; this concern reinforces the lower risk preference for LF-4N/PI-1N.

For the reasons cited above, LF-3C and LF-4N/PI-1N are ranked fourth and fifth, overall.

6.5.5 TRADEOFFS WITH TIER ONE

Tier one involves a three-way comparison of LF-1E, LF-9C and LF-1E/PI-27E. As in the Tier two comparisons, the initial preference favours the siting option (LF-9C) most highly ranked for risk to human health. However, as indicated in previous sections, the risk and impact differences involve some difficult tradeoffs and interpretations.

Tables 6.23, 6.24 and 6.25 highlight the reasons for each side of the three pairs of options: LF-1E vs. LF-1E/PI-27E (Table 6.23), LF-1E vs. LF-9C (Table 6.24) and LF-1E vs. LF-1E/PI-27E (Table 6.25).

Ultimately, the choice between any of the three pairs of options depends on:

- the assessment of individual risks and impacts associated with each option;
- the assessment of the overall risk differences favouring LF-9C over LF-1E;
- the assessment of the risk differences favouring LF-9C over LF-1E/PI-27E;
- the assessment of the overall impact differences favouring LF-1E/PI-27E over LF-1E and LF-9C;
- the assessment of the overall impact differences favouring LF-1E over LF-9C;
- the assessment of the importance of risks as compared with impacts.

With the LF-1E versus LF-1E/PI-27E comparison, a great deal depends on the importance attached to the industrial designation of LF-1E/PI-27E. In the final analysis, the industrial designation of PI-27E is treated as a significant consideration for the reasons stated in Section 6.4.4. As a result, the moderate impact differences favouring LF-1E/PI-27E more than offset the minor risk differences favouring LF-1E. In reaching this conclusion, it is recognized that the risk goal is more highly ranked than the impact goal. Another consideration which reinforces the preference for

LF-1E/PI-27E is the additional flexibility which two sites offer for avoiding hydrogeologic constraints. In view of the range of arguments in favour of either option both LF-1E and LF-1E/PI-27E have been compared against LF-9C.

Both the LF-1E versus LF-9C and the LF-1E/PI-27E versus LF-9C comparisons involve difficult choices[1].

6.6 COMBINING RISKS, IMPACTS AND COST/ENGINEERING FLEXIBILITY CONSIDERATIONS

6.6.1 INTRODUCTION

Engineering considerations do not play as prominent a role in the ranking of options as risk and impact considerations. This conclusion reflects the fact that cost is the third ranked goal of OWMC. It is also a reflection of the minor differences among the options (as described below) with respect to such concerns. As such, the engineering cost and flexibility considerations are used as minor tempering considerations in the comparative evaluation process.

6.6.2 COST

The cost comparison was undertaken by Monenco Ltd. (Refer to the report Site Selection Process: Phase 4A Selection of Preferred Site(s) -

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[1] OWMC assessed, with the assistance of its consultants, the risks, impacts and costs and concluded that LF-9C was the preferred siting option (see OWMC, 1985).

TABLE 6.23

Summary of Reasons for LF-1E and for LF-1E/PI-27E[1]

	Reasons Favouring LF-1E	Reasons Favouring LF-1E/PI-27E
Absolute Risks/Impacts	• avoids, to a greater extent, potential significant biological impacts	• consistent with municipal land use policies
Relative Risks/Impacts	• risks favour LF-1E; the risk goal is ranked more highly than the impact goal • not a major impact gap between two options; greater displacement and site vicinity impacts narrow socio-economic preference for LF-1E/PI-27E; gap partially offset by biological and air differences; without strong impact preference and very minor risk differences - difficult to select LF-1E/ PI-27E over LF-1E	• risk differences (favouring LF-1E) minor: - no difference - hydrogeology, transportation and surface water - chronic air - direct and indirect - acceptable under very conservative assumptions - acute risk - very remote potential; mitigation potential; acute emissions - low elevation sources favour LF-1E/PI-27E - air discipline difference limited based on factor suitability levels -2.3 versus -2.5 • impact differences (favouring LF-1E/PI-27E) more than minor: - strong socio-economic preference for LF-1E/PI-27E - biological impacts might occur with industrial designation - PI-27E - air, impact - small increment; low ranked factor - special importance attached to industrial designation warranted • on basis of above, major impact differences more than offset minor risk differences
Mitigation Potential	• no difference - transportation/surface water disciplines • limited mitigation potential with direct air factors (favouring LF-1E) more than offsets flexibility hydrogeologic advantage of LF-1E/PI-27E; air risk mitigation potential reinforces preference for LF-1E • LF-1E preferred for impacts and mitigation potential; air impacts not mitigable (LF-1E favoured); potential tourism impacts - uncertainty regarding if and extent to which can mitigate (LF-1E favoured) • on basis of above, risk and impact mitigation potential both appear to favour LF-1E	• no difference - transportation/surface water disciplines • air mitigation will largely occur at source; receptor differences minor • as hydrogeology highly ranked factor - additional flexibility to avoid constraints offered by two sites more than offsets moderate air receptor differences • tourism differences between two Niagara Falls sites very minor; air impacts very minor concern because OWMC facility such a minor increment • on basis of above, risk mitigation considerations (hydrogeologic flexibility) more than offset minor impact mitigation differences

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[1] The cases for each option should be read from top to bottom by heading, e.g. Absolute Risks/Impacts, rather than from left to right across options on a point-by-point basis.

TABLE 6.23

Summary of Reasons for LF-1E and for LF-1E/PI-27E[1]

	Reasons Favouring LF-1E	Reasons Favouring LF-1E/PI-27E
Uncertainty	• no difference - hydrogeologic, surface water and transportation uncertainties • air discipline risks favours LF-1E as LF-1E/PI-27E less favoured for acute events • tourism/acute air uncertainty potentially serious; favours LF-1E	• although no difference re. hydrogeologic uncertainty, because of two sites with LF-1E/PI-27E, greater potential to reduce uncertainty • limited uncertainties re. acute events - conservative design/operations and acute event determination; very low probability of occurrence
Policy Implications	• if LF-1E selected - consistent with ranking of risks over impacts • if LF-1E selected - lower potential acute air risks • if LF-1E selected reduces on-site displacement, potential tourism impacts and potential biological impacts	• limited risk differences between options • tourism impacts likely to be short term and minimal; also limited differences between options • biological and displacement effects could occur in any event with industrial development of site • small air increment should mean limited likelihood of impact by airshed management program • consistent with municipal land use policies; worth a high weight
Overall	• lower relative risk; reinforced by mitigation potential, uncertainty and policy implications • impact preference (even with higher weight for industrial designation) not sufficient to offset risk preference for LF-1E; even with impact preference for LF-1E/PI-27E gap narrowed by mitigation, uncertainty and policy impact considerations	• risk differences minor; impact differences sufficient to more than offset minor risk differences • flexibility to avoid hydrogeologic constraints provided by two sites more important for enhancing mitigation potential and for reducing uncertainty than minor air and tourism differences • compliance with municipal land use policies warrants particular importance in evaluation process; expectation of industrial development at PI-27E, in the future should temper displacement and vicinity differences

TABLE 6.24

Summary of Reasons for LF-9C and for LF-1E[1]

	Reasons Favouring LF-9C	Reasons Favouring LF-1E
Absolute Risks/Impacts	• limited land use and community character differences; LF-1E also in rural area; question of degree • no tourism impacts	• minimal conflict with community character • tourism impacts likely to be short-term and minor
Relative Risks/Impacts	• clear preference - hydrogeologic risk; levels one versus five for suitability levels • although same weighted suitability levels for air when alternative weighting scheme used, LF-9C favoured; also clear preference for LF-9C for acute emissions • less transportation risk because: - less likelihood of spills or accidents - less sensitive receptors from dividing point (Regional Road 24) between two options; Niagara Falls options through built-up area of St. Catharines and Niagara Falls • clear hydrogeologic and air differences and potentially equal or lower transportation risks (depending on assumptions re. weightings and study areas) more than offsets moderate surface water differences • for impacts - agriculture, land use and social preferences for LF-1E partially offset by economic base, municipal finance, biological and air impact preferences for LF-9C • on basis of above, risk differences outweigh impact differences; preference for LF-9C reinforced by high ranking of risk goal	• differences not natural containment but uncertainty re. natural containment; if uncertainty removed or greatly reduced by additional drilling, sites have close to comparable natural containment • local and regional access road system should not include portion of QEW because with local and regional roads: - OWMC generated traffic a high proportion of total traffic - function of roads less consistent with haulage of special wastes - people and sensitive uses such as schools, tend to be closer - lower design standards - greater level of pedestrians, school bus and agricultural uses - for reasons cited above definition of local and regional access roads should not be changed and greater weight should be given to local and regional access roads • surface water suitability favours LF-1E • air risks equal; same weighted factor suitability levels • transportation and surface water differences favouring LF-1E largely offset hydrogeologic differences favouring LF-9C • strong agriculture and social preference with moderate land use preference for LF-1E offsets moderate economic base impacts, moderate and mitigable municipal finance impacts, moderate biological differences and moderate air impact differences favouring LF-9C • on basis of above, major impact differences more than offset moderate risk differences
Mitigation Potential	• may not be possible to avoid hydrogeologic constraint • easier to monitor and to institute mitigative measures in area characterized by uniform hydrogeologic predictability; favours LF-9C	• not established, based on data available to date, that hydrogeologic mitigation required • if mitigation required, may be possible to mitigate hydrogeologic constraints

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[1] The cases for each option should be read from top to bottom by heading, e.g. Absolute Risks/Impacts, rather than from left to right across options on a point-by-point basis.

TABLE 6.24

Summary of Reasons for LF-9C and for LF-1E[1]

	Reasons Favouring LF-9C	Reasons Favouring LF-1E
Mitigation Potential (cont'd)	• residual uncertainty re. ability to mitigate constraints with Niagara Falls will remain greater even with additional drilling • greater potential to mitigate transportation risk along local and regional roads • mitigation of air risks likely to be easier in long term in a stable area with limited anticipated growth - LF-9C • moderate surface water risks mitigable particularly with greater level of natural containment at LF-9C • on basis of above, greater mitigation potential at LF-9C reinforces risk preference • not clear extent to which tourism impacts can occur and if so, extent to which can mitigate • on basis of above, greater net mitigation potential with LF-9C	• transportation risk already addressed through design/operations standards for QEW • mitigation may be more difficult in areas such as Vineland where sensitive uses are close to edge of road • mitigation for long term emissions not expected to be required; potential for health effects from acute emissions remote and largely mitigable at source • LF-1E in rural area with limited potential (as reflected in official plans) for major development • downstream use mitigation easier at Niagara Falls sites • mitigation risk differences only slightly favour LF-9C • agricultural community effects an important concern which may or may not be mitigable; closely linked to perception and attitudes • tourism impacts, particularly at LF-1E as compared to LF-1E/PI-27E, expected to be short term and minor • on basis of above, impact mitigation potential differences favour LF-1E and offset minor risk mitigation differences favouring LF-9C
Uncertainty	• much less uncertainty re. hydrogeologic conditions at LF-9C than at LF-1E • even with additional drilling residual uncertainty will be greater at Niagara Falls site • greater certainty re. ability to and effectiveness of mitigative measures - hydrogeologic constraints - with LF-9C • limited uncertainties re. air, transportation and surface water discipline • with transportation risk - best way to reduce uncertainty is to minimize likelihood of spills, accident and exposure, irrespective of road type (favours LF-9C) • minimizing air uncertainty would mean greater weight to direct, especially acute, air discipline; LF-9C preferred • less uncertainty re. acute risks if stable area with limited change potential (favours LF-9C)	• potential for reducing hydrogeologic uncertainty by drilling Niagara Falls site • more uncertainty re. downstream uses, with LF-9C • on basis of above, no major difference favouring LF-9C • uncertainties re. agricultural community impacts, as well as ability to mitigate such impacts • although some uncertainties re. tourism, expectations that impacts will be short-term and minimal • on basis of above, impact uncertainties (favouring LF-1E) almost completely offset risk uncertainties which favour LF-9C

TABLE 6.24

Summary of Reasons for LF-9C and for LF-1E[1]

	Reasons Favouring LF-9C	Reasons Favouring LF-1E
Uncertainty (cont'd)	• less uncertainty re. surface water discipline when potential for ground/surface water connections minimized (favours LF-9C) • on basis of above, risk uncertainties less with LF-9C than with LF-1E • considerable uncertainties re. prediction of tourism impacts • although uncertainties re. agricultural community impacts; many steps can be taken to minimize uncertainties and adverse, long term, indirect impact • on basis of above, impact uncertainties roughly balance out and risk uncertainties reinforce preference for LF-9C	
Policy Implications	• if LF-1E selected OWMC must accept uncertainty that site may subsequently prove to be hydrogeologically unsuitable • if LF-1E and LF-9C retained would: - delay facilities development process by several months or more (risk of delay) - continue uncertainty for residents and businesses both in Niagara Falls and West Lincoln regarding selection of site • none of the above would occur with the selection of LF-9C • selection of LF-9C consistent with ranking of risk goal over impact goal • selection of LF-9C means not necessary to accept risks associated with transport of special wastes through built up areas of St. Catharines and Niagara Falls • selection of LF-9C means greater hydrogeologic certainty and less direct air emission risks; also means not necessary to accept greater uncertainty regarding future land use changes in site vicinity • selection of LF-9C means not necessary to live with uncertainty re. tourism impacts • on basis of above, adverse policy implications more severe with LF-1E; reinforces preference for LF-9C	• by selecting LF-1E (but retaining LF-9C for further consideration) would mean taking steps to minimize uncertainty to enhance mitigation potential and to select most desirable siting option • by selecting LF-1E would mean that transport of special wastes confined to 400 series highways to a greater extent; roads designed for such uses; not necessary for example, to transport wastes through Vineland • by selecting LF-1E means placement of industrial-type facility in reasonably close proximity to similar uses and removed from stable agricultural areas; more consistent with provincial agricultural planning and with regional and local land use planning • by selecting LF-1E not necessary to accept potential impacts on agricultural community • tourism impacts short term and minimal; (especially for LF-1E as compared with LF-1E/PI-27E) • with LF-1E somewhat greater opportunities for enhancement of industrial growth opportunities through service extensions and through links to nearby existing and possibly future industrial/service uses • on basis of above, policy implications only slightly favour LF-9C

TABLE 6.24

Summary of Reasons for LF-9C and for LF-1E[1]

	Reasons Favouring LF-9C	Reasons Favouring LF-1E
Overall	• clear risk differences and minor impact differences • higher ranking of risks, greater mitigation potential, less uncertainty and less adverse policy implications all reinforce preference for LF-9C	• minor risk differences and clear impact differences result in preference for LF-1E even allowing for higher ranking of risk goal • mitigation differences balance out and minor uncertainty and policy implication differences insufficient to alter overall preference for LF-1E

TABLE 6.25

Summary of Reasons for LF-9C and for LF-1E/PI-27E[1]

	Reasons Favouring LF-9C	Reasons Favouring LF-1E/PI-27E
Absolute Risks/Impacts	• limited land use and community character differences • less impact on sensitive/significant biological resources	• consistent with municipal land use policies (industrial designation - PI-27E) • minimal conflict with community character • biological impacts, relative differences not absolute impacts; not highly significant or sensitive; impacts not severe and potentially mitigable; impacts at PI-27E would likely occur in any event with industrial development at site
Relative Risks/Impacts	• clear preference for LF-9C - hydrogeologic and air risks; local hydrogeologic variability a long term concern; air differences - gap widens when greater weight attached to acute risks and with long term urban development in vicinity of Niagara Falls options • less transportation risks with LF-9C: - less likelihood of spills or accidents - less sensitive receptors from dividing point (Regional Road 24) between two options - Niagara Falls options through built up area of St. Catharines and Niagara Falls • other risk disciplines outweigh moderate surface water differences favouring LF-1E/PI-27E • agriculture, social and land use preferences for LF-1E/PI-27E partially offset by economic base, municipal finance, biological and air impact preferences for LF-9C • no tourism impacts • even with impact preference for LF-1E/PI-27E not sufficient to offset risk preference for LF-9C; preference reinforced by higher ranking of risk goal • extremely high weight to industrial designation for PI-27E not consistent with minimizing impact; questionable argument re. PI-27E being developed for industrial use in any event; with very large supply of industrial land in Niagara Falls, development of industrial use at PI-27E very long term at best; also not certain industrial use will be comparable to OWMC in terms of potential displacement/vicinity impacts, e.g. warehousing	• hydrogeologic differences not natural containment but uncertainty re. natural containment; if uncertainty greatly reduced, sites have close to comparable natural containment • local and regional access road system should not include portions of QEW because with local and regional roads: - OWMC generated traffic high proportion of total traffic - function of roads less consistent with haulage of dangerous goods - people and sensitive uses such as schools, tend to be closer - lower design standards - greater level of pedestrian, school bus and agricultural uses • for reasons cited above definition of local and regional access road should not be changed and greater weight should be given to local and regional access roads • surface water suitability favours LF-1E/PI-27E • air differences limited: - chronic emissions all acceptable, even with very conservative assumptions - acute emissions - topographic constraints - minor, mitigable concern - stack emissions - not a health concern - acute emissions - low elevation sources, therefore, crucial; for existing and future population, PI-27E favoured over LF-9C and only slight difference favouring LF-9C for community facilities • on basis of above, transportation and, to a lesser extent, surface water differences largely offset hydrogeologic and air differences; particularly if recognized that hydrogeologic differences more a matter of uncertainty than relative risk and if air risk analyses focus on upset emissions - low level sources

[1] The cases for each option should be read from top to bottom by heading, e.g. Absolute Risks/Impacts, rather than from left to right across options on a point-by-point basis.

TABLE 6.25

Summary of Reasons for LF-9C and for LF-1E/PI-27E[1]

	Reasons Favouring LF-9C	Reasons Favouring LF-1E/PI-27E
Relative Risks/Impacts (cont'd)		• on basis of above, risk differences minor and offset by major impact differences • impact preference LF-1E/PI-27E over LF-9C; clear socio-economic preference more than offsets clear biological and air preferences for LF-9C; with biological impacts, assumption that PI-27E could be developed for industrial purposes in the future (timing of industrial development not possible to predict); with air impacts, recognition that OWMC emissions a minor increment • many reasons for greater weight for industrial designation: - statement of municipal policy - consistent with current and future character of area - reflects expectations of residents and other uses - service extensions could facilitate industrial development in areas designated for such uses • on basis of above clear impact differences, favouring LF-1E/PI-27E, more than offset minor risk differences, favouring LF-9C
Mitigation Potential	• with LF-1E/PI-27E, may not be possible to avoid hydrogeologic constraint even with two sites • easier to monitor and to institute mitigative measures in area characterized by uniform hydrogeologic predictability; favours LF-9C • residual uncertainty re. ability to mitigate constraints in Niagara Falls; will remain greater even with additional drilling • greater potential to mitigate transportation risk along local and regional roads • mitigation of air risks at LF-9C likely to be easier in long term in a stable area with limited anticipated growth • moderate surface water risks mitigable particularly with greater level of natural containment • greater mitigation potential at LF-9C reinforces risk preference • not clear extent to which tourism impacts will occur, and if so, extent to which can mitigate • not possible for OWMC to mitigate air quality although operations of facility may be affected	• with two sites, possible to enhance potential for avoiding hydrogeologic constraints • based on data available to date not established that hydrogeologic mitigation required • transportation risk already addressed through design/operation standards for QEW • mitigation may be more difficult in areas such as Vineland, where sensitive uses are close to edge of road • mitigation for short term releases will occur on-site • mitigation for short term releases favour site (PI-27E) with lowest rating - upset emissions - low level sources • downstream use mitigation easier at Niagara Falls sites • risk mitigation differences marginal either way • agricultural community effects an important concern which may or may not be mitigable; closely linked to perception and attitudes • tourism impacts expected to be short term and minimal

TABLE 6.25

Summary of Reasons for LF-9C and for LF-1E/PI-27E[1]

	Reasons Favouring LF-9C	Reasons Favouring LF-1E/PI-27E
Mitigation Potential (cont'd)	• on basis of above, greater net mitigation potential with LF-9C	• as OWMC would be such a minor contributor to emissions (small fraction of standards and guidelines), air mitigation not likely to be required • mitigation may not be necessary for biological resource impacts; if needed can be provided through off-site enhancement of biological resources • mitigation potential only slightly favours LF-9C; depending on weight placed on agricultural community effects and ability to mitigate; could make case that LF-1E/PI-27E is favoured
Uncertainty	• much less uncertainty re. hydrogeologic conditions at LF-9C than at LF-1E/PI-27E • even with additional drilling residual uncertainty will be greater at Niagara Falls sites • greater relative opportunity re. ability to and effectiveness of mitigative measures - hydrogeologic constraints • limited uncertainties re. air, transportation and surface water disciplines	• potential for reducing hydrogeologic uncertainty by drilling Niagara Falls sites • with air risks greatest uncertainty are for acute emissions - ground level; selecting LF-1E/PI-27E minimizes such potential risks • more uncertainties re. downstream uses with LF-9C • on basis of above, risk uncertainties slightly favour LF-9C
Uncertainty	• with transportation risks - best way to reduce uncertainty is to minimize likelihood of spills, accidents and exposure, irrespective of road type (favours LF-9C) • minimizing air uncertainty would mean great weight to direct air discipline; results in stronger preference for LF-9C • less uncertainty re. acute air risks in stable area with limited change potential (favours LF-9C) • less uncertainty re. surface water discipline when potential for ground/surface water connection minimized (favours LF-9C) • on basis of above risk uncertainties less with LF-9C than with LF-1E/PI-27E • considerable uncertainties re. prediction of tourism impacts • although uncertainties re. agricultural community impacts, many steps can be taken to minimize uncertainties and adverse, long term indirect impacts • on basis of above, impact uncertainties roughly balance out and risk uncertainties reinforce preference for LF-9C	• considerable uncertainties re. agricultural community impacts, as well as ability to mitigate such impacts • although some uncertainty re. tourism impacts, expectation that impacts will be short term and minimal • on basis of above, risk and impact uncertainties roughly balance out

TABLE 6.25

Summary of Reasons for LF-9C and for LF-1E/PI-27E[1]

	Reasons Favouring LF-9C	Reasons Favouring LF-1E/PI-27E
Policy Implications	• if LF-1E/PI-27E selected by itself, OWMC must be willing to accept uncertainty that sites may subsequently prove to be hydrogeologically unsuitable • if necessary to keep all options within and among LF-9C, LF-1E and PI-27E open would: - delay facilities development process by several months or more - contribute to ongoing risks resulting from no facility - continue uncertainty for residents and businesses in both Niagara Falls and West Lincoln • none of above would occur with selection of LF-9C • selection of LF-9C, consistent with ranking of risk goal over impact goal • selection of LF-9C means not necessary to accept risks associated with transport of special wastes through built up areas of St. Catharines and Niagara Falls • selection of LF-9C means greater hydrogeologic certainty and less direct air emissions risks; also means not necessary to accept greater uncertainty re. future land use changes in site vicinity • selection of LF-9C means not necessary to live with uncertainty re. tourism impact potential • facility not expected to attract secondary industry; to the extent that opportunities exist, still possible to locate related uses elsewhere in region or in site vicinity • with selection of LF-9C, means not necessary to live with uncertainty of operational implications in event facility receives special controls as part of an airshed management program • on basis of above, adverse policy implications more severe with LF-1E/PI-27E; again LF-9C favoured	• by selecting LF-1E/PI-27E (but retaining LF-9C for further consideration) means taking steps to minimize uncertainty, enhance mitigation potential and select most desirable option • by selecting LF-1E/PI-27E transport of materials confined to 400-series highways to a greater extent; roads designed for such uses • by selecting LF-1E/PI-27E means placement of industrial-type facility in industrial area; more consistent with provincial agricultural planning and with regional and local land use planning • by selecting LF-1E/PI-27E not necessary to accept potential impacts on agricultural community • by selecting LF-1E/PI-27E minimizes acute ground level emission risks • tourism, biological and air impact policy concerns not major because: - tourism impacts minor and short term (see previously cited reasons) - biological impacts not demonstrated as severe in an absolute sense; impacts could occur in any event with industrial development at PI-27E - emissions from OWMC facility such a small increment unlikely to be seriously affected by airshed management - with LF-1E/PI-27E somewhat greater opportunities for enhancing industrial growth opportunities through service extensions and through links to nearby existing and possibly future industrial/service uses • on basis of above, policy implications balance out or perhaps favour LF-1E/PI-27E
Overall	• clear risk differences and minor impact differences • higher ranking of risks, greater mitigation potential, less uncertainty and less adverse policy implications all reinforce preference for LF-9C	• minor risk differences and clear impact differences tip the balance in favour of LF-1E/PI-27E even allowing for higher ranking of risk goal • mitigation potential, uncertainty and policy implications roughly balance out • LF-1E/PI-27E favoured

Engineering, 1986, prepared by Monenco Ltd., for details regarding the procedures and assumptions employed in the cost comparison.) Costs were aggregated using present value of lifecycle annual costs in 1984 Canadian dollars (million). The ranking of the options on this basis was as follows:

Option	Ranking	Cost ($000,000)
LF-4N/PI-1N	1	567
LF-4N/PI-13N	2	570
LF-9C	3	572
LF-3C	3	572
LF-1E	4	595
LF-1E/PI-27E	5	606

In analysing the results of the cost analysis, Monenco Ltd. noted that the total cost spread from highest to lowest siting options is 7%. The Monenco report also points out that, "The preliminary engineering that formed the basis for establishing facility characteristics information was of a level of detail such that the preliminary cost estimates produced are considered to have a level of accuracy within +30% and -18%" (Monenco Ltd., 1986, p.xi).

Inasmuch as the cost spread among the options is less than the level of accuracy of the cost estimates, the engineering consultant concluded that, from a cost perspective, the options should be "given low importance in the selection of preferred site(s)" (Monenco, 1986, p.156).

On the basis of the above, no adjustments have been made to the risk/impact siting option rankings.

6.6.3 ENGINEERING FLEXIBILITY

A further set of engineering considerations incorporated into the comparative analysis (in the form of a sensitivity analysis) pertain to engineering flexibility. The purpose of the engineering flexibility analysis was, "...to determine if the design development of the facility (which is proceeding in parallel with Phase 4A site selection) would be significantly constrained by the selection of any siting option" (Monenco, 1986, p.126).

The engineering flexibility factor addresses two aspects of the design development - facility design and facility layout. Facility design choices considered included:

- landfill design
  - conventional
  - above ground
  - shallow entombed;
- effluent disposal
  - evaporation with discharge of water vapour to atmosphere (see Appendix G)
  - treatment in the solidification plant and disposal in the engineered landfill
  - discharge or a pipeline to a receiving body.

Flexibility layout choices included:

- conceptual arrangement
  - modular
  - rectangular;
- rail access for bulk transportation of additives and reagents;
- location of incinerator stack (flexibility to shift location within site);

- expansion of technical buffer zone (flexibility to expand boundaries of technical buffer zone without changing site boundary);

- expansion of landfill area (flexibility to expand landfill area beyond site boundaries without severe road, rail or utility easement constraints).

Each of these options is described in greater detail in the Phase 4A Engineering Report (Monenco, 1986).

The differences among the siting options, as determined through the application of the flexibility factor, are highlighted in Table 6.26. In analysing engineering flexibility, the engineering report notes that, "...different siting options exhibited differing flexibility in being able to accommodate the various options being considered by OWMC and provide a greater degree of freedom to the engineering consultant (Monenco Limited) to produce the optimal design" (Monenco, 1986, p.155).

"However, although the differences in flexibility between siting options are not viewed as a major constraint to OWMC or their engineer in finalizing a satisfactory conceptual design for the preferred site(s) LF-3C and LF-9C are ranked higher than the other siting options due to their ability to accommodate all three landfill types under consideration and the relative ease with which their landfill areas could potentially be expanded" (Monenco, 1986, p.156).

In comparing the options, the engineering report concluded, "that from a flexibility basis, LF-3C which provides the most flexibility is ranked first with LF-9C a close second and the remaining siting options all ranked equal third" (Monenco, 1986, p.157).

TABLE 6.26

Application of Flexibility Factor

STUDY AREA	FACTOR GROUPING	FACTOR	INDICATOR	CASE 1 INTEGRATED			CASE 2 LANDFILL SEPARATE		
				LF-9C	LF-3C	LF-1E	LF-4N/ PI-1N	LF-4N/ PI-13N	LF-1E/ PI-27E
Site	Engineering	Flexibility	Facility Design:						
			o Landfill Design						
			- Conventional	+	+	+	+	+	+
			- Above Ground	+	+	+	+	+	+
			- Shallow Entombed	+	+	-	-	-	-
			o Effluent Disposal Option						
			- Evaporation	+	+	+	+	+	+
			- Trucking	+	+	+	+	+	+
			- Pipeline	+	+	+	+	+	+
			Facility Layout:						
			o Conceptual Arrangement						
			- Modular	-	+	+	+	+	+
			- Rectangular	+	+	+	+	+	-
			o Rail Access for Bulk Transportation of Additives & Reagents	+	+	+	+	-	+
			o Location of Incinerator Stack	-	+	+	-	+	+
			o Expansion of Technical Buffer Zone	-	+	+	+	+	+
			o Expansion of Landfill Area	+	+	-	-	-	-

Note: + = the siting option provides the flexibility
- = the siting option does not provide the flexibility

Source: Monenco, 1986

The remaining siting options are all ranked equal-third following LF-3C and LF-9C" (Monenco, 1986, p.134).

On the basis of the preceding analysis, neither the cost analysis nor the engineering flexibility analysis should alter the siting options rankings. The OWMC preference for LF-9C over the Niagara Falls options is, if anything, reinforced by engineering cost and flexibility considerations.

7.0 QUANTITATIVE AGGREGATION OF FACTORS

7.1 INTRODUCTION

7.1.1 PURPOSE

This chapter summarizes the results of the quantitative aggregation[1] of the factor rankings[2] and factor suitability levels[3].

Site selection risks and impacts are combined or aggregated by summing the products of factor rankings and factor suitability levels (FSLs). Impact factors are aggregated on both a study area and a disciplinary basis to reflect distinctions addressed in Chapter 5 (Differences and Tradeoffs Synthesis) and Chapter 6 (Disciplinary Synthesis). For each of the six siting options an attractiveness score is derived.

Comparisons are made both among siting options and against a hypothetical best siting option* (HBS)[4]. Error estimates[5] have also been included to assess significance of differences interpretations of the scores for the options.

---

[1] Aggregation refers to a numerical procedure for combining measures of importance (factor rankings) with measures of risk and impact magnitude (factor suitability levels).

[2] The factor ranking process is described in Chapter 4 of this volume.

[3] The procedures employed to derive factor suitability levels are described in Chapter 5 of this volume.

[4] The hypothetical best siting option represents the sum of the best factor suitability levels across the siting options.

[5] Error limits of 1% and 5% of mean total factor scores (for the six siting options) for each procedure are applied. These were selected to represent a reasonable estimate of minor and more moderate error.

7.1.2 RELATIONSHIP TO OTHER REPORT SECTIONS AND REPORTS

The quantitative aggregation procedure presented in this chapter builds upon the procedures undertaken by the individual site selection consultants to combine their indicator and factor suitability levels and rankings. The transportation, agriculture, social, air quality, land use and economic consultants each employed a quantitative aggregation procedure. Reference should be made to the individual site selection reports for details on these procedures (see List of References).

The quantitative aggregation procedures provide results which can be compared to those summarized in Chapter 5 and Chapter 6. In these two chapters two approaches were used - differences and tradeoffs synthesis and the disciplinary synthesis. A critique of these is given in Chapter 1, Volume 2.

Both the differences and tradeoffs synthesis and the disciplinary synthesis involved some numerical interpretations of site selection data. In both cases the factor rankings facilitated interpretations of the importance of identified differences between siting options. The disciplinary synthesis used the consultants' quantitative aggregation results to assist in the interpretation of differences. The differences and tradeoffs synthesis used factor suitability levels to assist in identifying and evaluating major risks and impacts, differences and tradeoffs.

This chapter provides an overview of the quantitative aggregation approach and results. Appendix F provides additional detail on the adjustments made to consultants' inputs and on the differences between the results from this procedure and the procedures employed by the other site selection consultants.

Chapter 8 contains the sensitivity analyses undertaken to determine the implications of alternative assumptions regarding facility characteristics, temporal[1] and spatial boundaries[2], the magnitude and importance of predicted risks and impacts and the effectiveness of mitigation/compensation measures. Inasmuch as this chapter involves assumptions which could be varied, the sensitivity analyses presented in Chapter 8 are important to the formation of overall conclusions.

Chapter 9 compares the results of the quantitative aggregation, the disciplinary synthesis, the differences and tradeoffs synthesis and the sensitivity analyses in deriving overall conclusions and recommendations.

7.1.3 CHAPTER FORMAT

The chapter begins with an overview of the general approach to quantitative aggregation (Section 7.2). The aggregation process is described, the major assumptions are highlighted and the general procedure is presented. As previously noted, details regarding the relationship of the procedures employed here to those employed by the other site selection consultants are presented in Appendix F.

After some adjustments to exclude factors involving double-counting and negligible differences (Section 7.2.1), the quantitative aggregation is presented (Section 7.3).

The quantitative aggregation is presented in the following manner:

- aggregation by risk pathway (Section 7.3.1a);
- aggregation of risk pathways (Section 7.3.1b);
- aggregation by impact discipline (Section 7.3.2a);

---

[1] This analysis involves alternative assumptions regarding future patterns of development.

[2] This analysis involves alternative assumptions regarding site, site vicinity and access road boundaries.

- aggregation of impact disciplines (Section 7.3.2b);
- aggregation by impact study areas (Section 7.3.2a);
- aggregation of impact study areas (Section 7.3.2b);
- aggregation of risk pathways and impact disciplines and risk pathways and impact study areas (Section 7.3.3);
- overall conclusions (Section 7.4).

7.2 APPROACH

7.2.1 AGGREGATION PROCESS

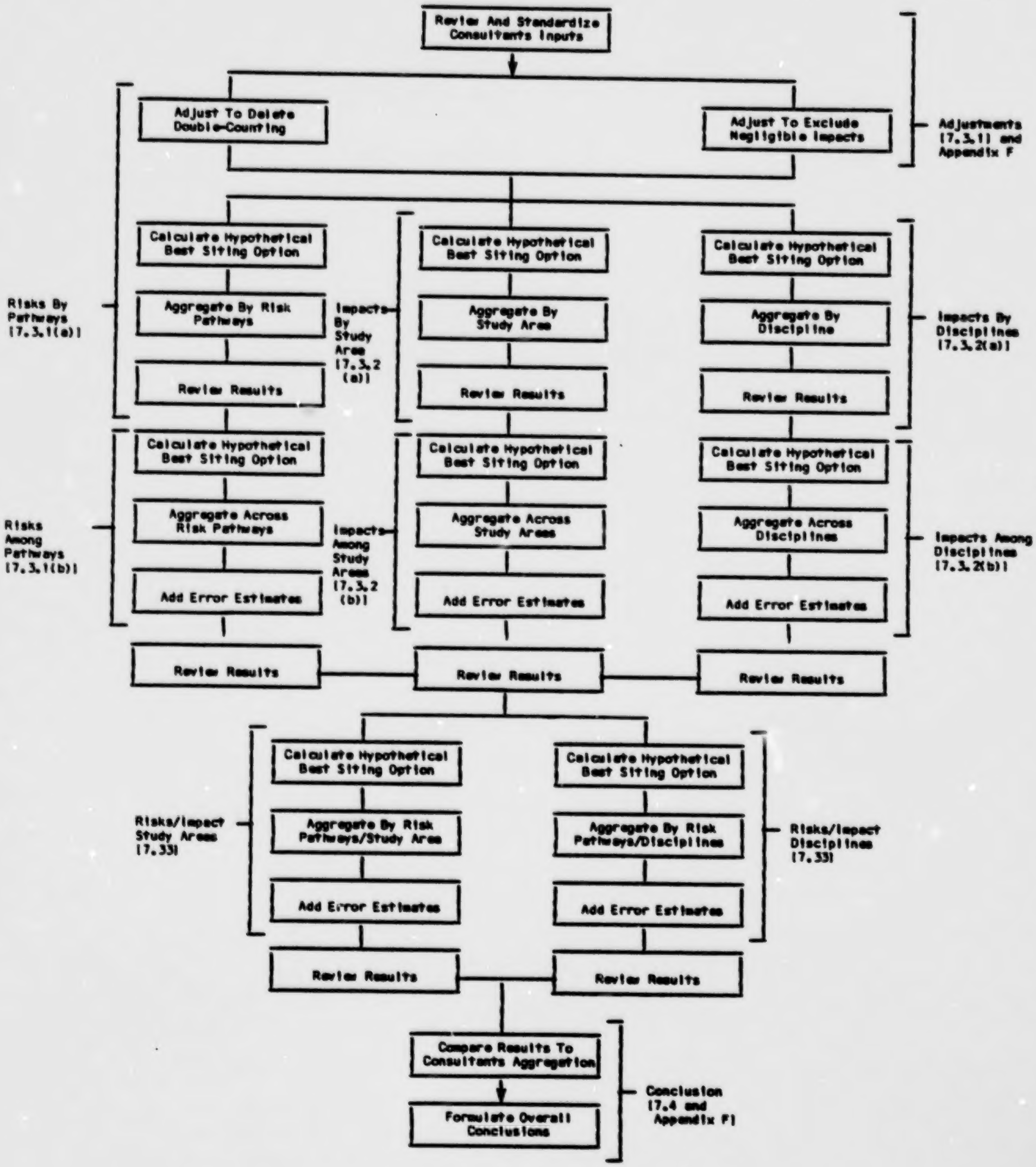
The quantitative aggregation process is illustrated in Figure 7.1. The procedures employed by the consultants to combine their indicator and factor rankings with their indicator and factor suitability levels were first reviewed. A number of adjustments were made to ensure consistency and to combine impact factors on both a study area and a disciplinary basis. The individual adjustments instituted for each consultant's inputs are detailed in Appendix F.

In the case of two factors - archaeological resources and the displacement of community and recreation and historic features - anticipated impacts were expected to be limited. There was also a commitment by OWMC to full mitigation. In the case of archaeological resources, the differences among the siting option were minimal (GLAL and MIA, 1985). In the case of the displacement of community, recreation and historic features, impacts were anticipated to be so limited that they were screened from the social consultants final analysis (IER, 1985a). For the reasons cited above, the two factors were screened from the quantitative aggregation.

Some factors or indicators were applied in the comparison of siting options by more than one consultant because they provided a perspective important to each discipline's overall conclusions. These overlaps do not

FIGURE 7.1

Quantitative Aggregation Process


Review And Standardize Consultants Inputs
Adjust To Delete Double-Counting
Adjust To Exclude Negligible Impacts
Adjustments [7.3.1] and Appendix F
Calculate Hypothetical Best Siting Option
Aggregate By Risk Pathways
Review Results
Risks By Pathways [7.3.1(a)]
Calculate Hypothetical Best Siting Option
Aggregate By Study Area
Review Results
Impacts By Study Area [7.3.2 (a)]
Calculate Hypothetical Best Siting Option
Aggregate By Discipline
Review Results
Impacts By Disciplines [7.3.2(a)]
Calculate Hypothetical Best Siting Option
Aggregate Across Risk Pathways
Add Error Estimates
Risks Among Pathways [7.3.1(b)]
Calculate Hypothetical Best Siting Option
Aggregate Across Study Areas
Add Error Estimates
Impacts Among Study Areas [7.3.2 (b)]
Calculate Hypothetical Best Siting Option
Aggregate Across Disciplines
Add Error Estimates
Impacts Among Disciplines [7.3.2(b)]
Review Results
Review Results
Review Results
Calculate Hypothetical Best Siting Option
Aggregate By Risk Pathways/Study Area
Add Error Estimates
Risks/Impact Study Areas [7.3]
Calculate Hypothetical Best Siting Option
Aggregate By Risk Pathways/Disciplines
Add Error Estimates
Risks/Impact Disciplines [7.3]
Review Results
Review Results
Compare Results To Consultants Aggregation
Formulate Overall Conclusions
Conclusion [7.4 and Appendix F]

present a problem for the qualitative synthesis procedures because the common factors restate identified impacts. When these measures of impacts are combined numerically, they are counted twice. As a result, the following adjustments were made to remove cases of double-counting.

Deletion	**Rationale**
° Land use stability (all study areas)	° Social stability and stability of farm population factors measure specific aspects of the potential for and history of social change. ° The data for the site vicinity study area are, in this case, of limited reliability.
° Existing land use (site, site vicinity, community and regional, access roads)	° Impacts on residents and community and recreation features were considered by the social consultant; number of residences (an indicator for existing land use) is a less accurate measure of impacts. ° Impacts on industrial and commercial uses are addressed by economic consultants' factors. ° Impacts on agriculture are addressed by the agriculture consultants' factors.

Risks were aggregated by risk pathway. Impacts were aggregated by both study area and discipline. The initial step in each case was the calculation of a hypothetical best siting option. The hypothetical best siting option is the sum of the best factor suitability levels across the siting options. It served as a bench-mark against which the siting options could be compared.

Factor suitability levels and factor rankings were then aggregated. Risk factors were aggregated by risk pathway by summing the products of factor ranking and suitability levels (factor scores*) and dividing by the number of factors. Impact factors were aggregated using two procedures. The factor scores were aggregated by discipline and by study area. Reasonable error limits of 1% and 5% of the mean factor scores were applied to the factor scores. The resulting numbers were displayed in graph form.

The results derived by the individual consultants were cross-checked. Finally, overall conclusions were formulated.

7.2.2 ASSUMPTIONS

The following assumptions were employed in the aggregation of factor rankings and factor suitability levels (FSLs):

- o The judgements made by individual site selection consultants, regarding scaling limits and the weighting of subindicators and indicators, were assumed to be accurate and consistent[1].
- o Complex interactions between factors in the analysis were not considered; an additive model was used.
- o The analysis assumed constant marginal utility* for all factors[2].

---

[1] Adjustments have been made to consultants' factor suitability levels (FSL) to ensure consistency among consultants (see Appendix F).

[2] Constant marginal utility occurs when successive units of impact or risk are assumed to cause a constant increase in total impact or risk. This is in contrast to a situation where, for example, a threshold exists above which total impacts increase at a much faster rate for each unit of impact.

- The significant error range was not considered for each factor. Rather, all differences were considered meaningful[1].

- In the case of indicators or factors not having numerical parameters, the indicator scaling levels and factor suitability levels were assigned by the consultants. These FSLs were treated as interval data[2] for the purpose of this analysis.

- The site selection team's factor rankings were applied as factor weights in the quantitative analysis. Because these rankings differed from the consultants' factor rankings, in some cases, the results of the quantitative analyses do not match exactly those of the individual consultants. The differences are identified and reviewed in Appendix F.

- Further consideration is given to the magnitude of importance between factors and to the magnitude of predicted risks and impacts in Chapter 8.

- Cost and engineering flexibility are not included in this analysis. This assumption reflects the limited engineering differences among options and the lower importance attached by OWMC to cost as compared to risks and impacts. As a result, costs and engineering flexibility are treated qualitatively to temper the risk and impact analyses (see Chapters 5, 6, 8 and 9).

- Risks and impacts have been ranked at the same level although OWMC has attached greater importance to risks as compared to impacts. Alternative weights for risks and impacts are addressed in Chapter 8 - Sensitivity Analyses.

---

[1] Reasonable error limits of 1% and 5% of the mean total factor scores for each procedure were applied in the presentation of results.

[2] The factor suitability levels assigned represent the interval of difference between the options.

7.2.3 AGGREGATION PROCEDURES

As previously noted, some adjustments were made to standardize the factor suitability levels among consultants. The standardized factor suitability levels have the following characteristics:

- all FSLs range from 0 to -5.0 for negative risks and impacts (and from 0 to +5.0 for positive impacts for the municipal finance factor);
- all FSLs represent the differences between options relative to the lowest (or worst) siting option (or the best option for municipal finance);
- all FSLs include a "0" for no occurrence of the factor;
- for all factors, the higher the score, the more attractive the option.

The factor rankings also range from 0 to 5[1]. The larger the number, the greater the importance attached to the factor. For each of the 66 risk and impact factors, the factor suitability level was multiplied by the factor rank (assumed to be a weight) to produce a factor score. The factor scores were summed by risk pathway, impact discipline and impact study area and divided by the number of factors. This produced a risk pathway, impact discipline or study area average factor score.

The score for each risk pathway and study area was calculated as follows:

$$\text{Discipline, Risk Pathway or Study Area Average Score} = \frac{\sum(\text{FSL X Factor Weight})}{\text{Number of Factors}}$$

The average factor scores were summed to determine the impact, risk and combined total score. The results of these calculations are contained in Table F.5 (unadjusted for factor overlaps) and Table F.6 (adjusted for factor overlaps) in Appendix F.

---

[1] These rankings are proportional to factor rankings from 1 to 10 documented in Chapter 4.

The following is a hypothetical example of the procedure used to sum factor scores:

Step 1: Calculation of Average Factor Score

Example LF-3C Transportation

Factor	Factor Suitability Level	Factor Weight	Factor Score (FSL x Weight)
Risk			
Transportation Spills - local and regional access roads	-5.0	5	-25.0
Transportation Spills - province-wide access system	-3.3	4	-13.2
Transportation Accidents - local and regional access roads	-5.0	5	-25.0
Transportation Accidents - province-wide access system	-3.2	4	-12.8
	Total Score		-76.0
	Average Score for Discipline (Total Score ÷ Number of Factors; i.e. 76 ÷ 4)		-19.0

Step 2: Combine Average Factor Scores

	Siting Option (1)		Siting Option (2)	
Risk Pathway	Average Factor Score	(FSL X Factor Weight)	Average Factor Score	(FSL X Factor Weight)
Transportation	-19		-14	
Air Quality	-10		-12	
Impacts Discipline				
Social	-12		-20	
Agriculture	-12		-15	
Municipal Finance	+ 4		+10	
Total Score	-49		-51	

Step 3: Calculate Error

(A)		(B)	(C)		
Total Score					
Siting Option (1)	Siting Option (2)	Sum of Total Scores	Mean of (B)	1% of (C)	5% of (C)
-49	-51	-100	-50	0.5	2.5

Therefore error limits for total score are: ± 0.5 for 1% error
± 2.5 for 5% error

The positive municipal benefits are represented by a positive factor score. This positive score is added to the negative risks and impacts measured for each option. In the example above, Siting Option (1) is more attractive because it has a higher total factor score (-49 versus -51).

Two aggregation procedures were employed, one to aggregate factors by risk pathway and impact study area and the other to aggregate factors by risk pathway and discipline.

Under the first procedure (Procedure 1) the factors were grouped according to the risk pathways (transportation, air quality, hydrogeology and surface water) and study areas (site, site vicinity, access routes, community and regional) contained in Table B.1 in Appendix B.

In order to derive an average score for each discipline, the factors were grouped by discipline and the calculations used in Procedure 1 were repeated. The discipline groupings were the same as those applied by the individual consultants with two exceptions. The air quality factors were divided into risk and impact factors and treated as separate disciplines. The composite Economic Base factor, derived by the economic consultant, was treated as one discipline. This procedure is referred to as Procedure 2.

The results of both procedures are contained in Table F.7 (unadjusted for factor overlaps) and F.8 (adjusted for factor overlaps) in Appendix F.

7.3 RESULTS OF THE QUANTITATIVE AGGREGATION

7.3.1 RISK PATHWAYS

a) Individual Risk Pathways

Figure 7.2 presents the results of the quantitative analysis by risk pathway. The hypothetical best siting option is also plotted to provide a bench-mark against which the other options can be compared.

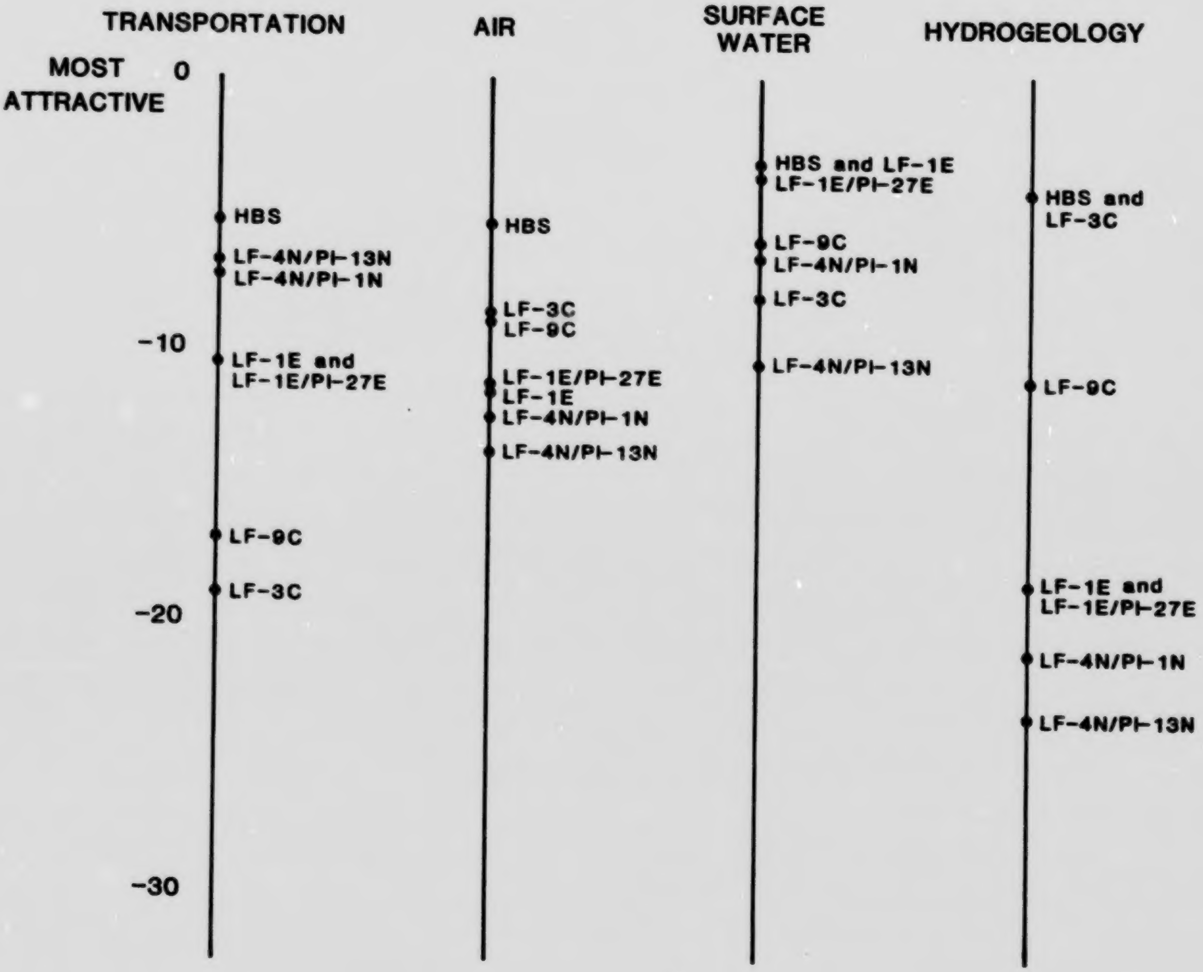
The following general patterns are evident from Figure 7.2:

- The two Milton siting options are similar and closest to the hypothetical best siting option for transportation risk. The Niagara siting options are equal and moderately ranked for transportation risk. The West Lincoln sites are close together and have the highest potential transportation risk. LF-9C is slightly preferred over LF-3C.

- The results for the air pathway indicate that all options are grouped relatively close together. None of the options is very close to the hypothetical best siting option. The West Lincoln options have the least risk, with LF-3C slightly preferred. There is a negligible difference between the Niagara Falls options which are moderately ranked. The Milton options have similar scores and are least preferred.

- The surface water scores are grouped together. The Niagara Falls options are equal to (for LF-1E) and very close to (for LF-1E/PI-27E),

Figure 7.2
Quantitative Aggregation of Risk Factors



HBS=HYPOTHETICAL BEST SITING OPTION

the hypothetical best siting option. LF-4N/PI-1N and LF-9C have similar scores and are moderately ranked. LF-3C and LF-4N/PI-13N are ranked second last and last, respectively.

- There is a more distinctive spread among the options for the ground water pathway. LF-3C is equal to the hypothetical best siting option. The Niagara Falls and Milton options are grouped together. The Niagara Falls options are ranked at the same level, well below the hypothetical best siting option. LF-4N/PI-1N and LF-4N/PI-13N are the least preferred options. They have lower scores than the Niagara options. LF-9C is ranked between LF-3C/hypothetical best siting option and the remaining options.

b) Combined Risk Pathways

Figure 7.3 shows the ranking of siting options for the aggregated risk factors. Using a 1% error estimate, the following ranking results:

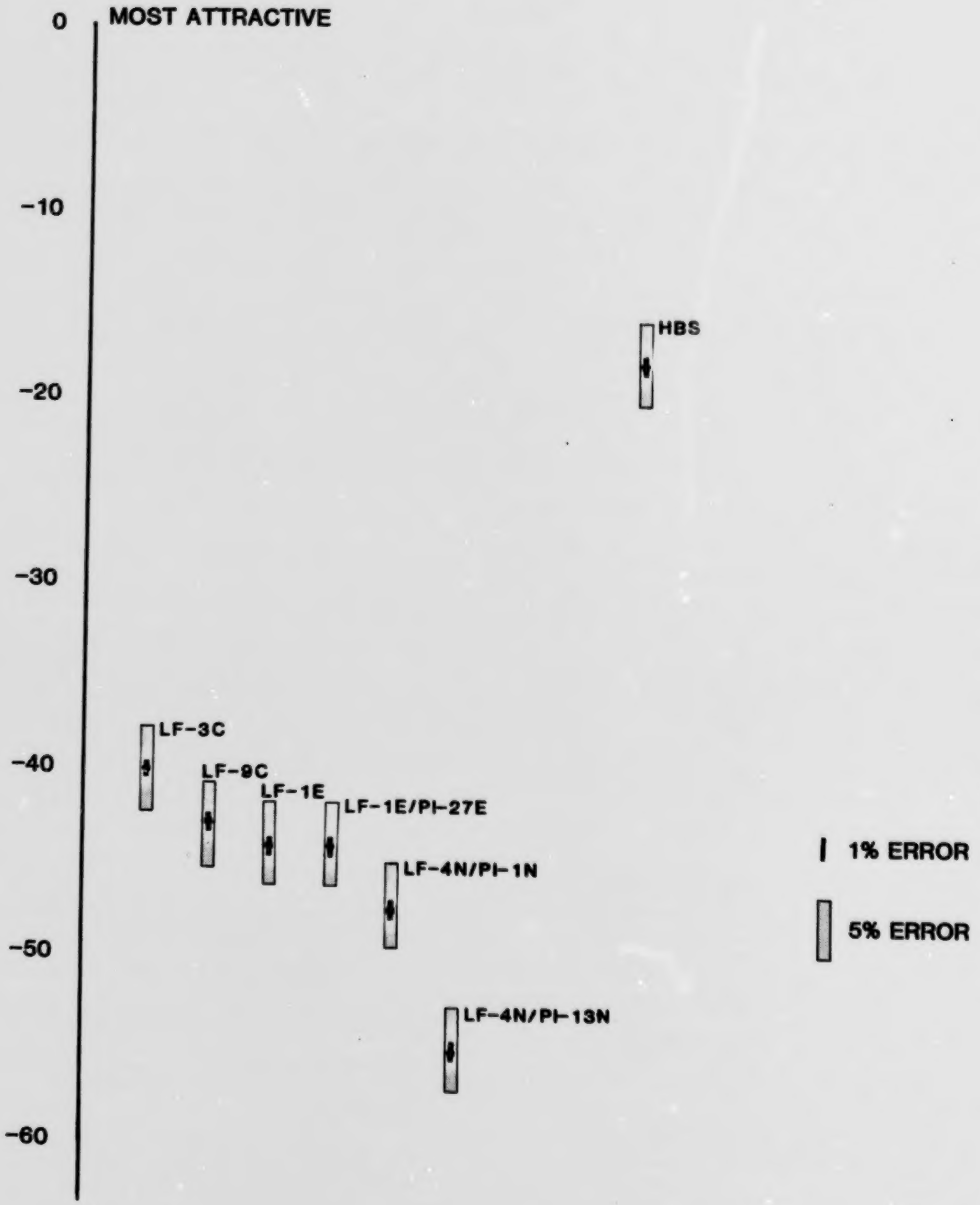
1. LF-3C;
2. LF-9C and LF-1E and LF-1E/PI-27E;
3. LF-4N/PI-1N;
4. LF-4N/PI-13N.

Using a 5% error estimate, the following ranking results:

1. LF-3C, LF-9C, LF-1E, LF-1E/PI-27E;
2. LF-4N/PI-1N
3. LF-4N/PI-13N.

LF-3C is slightly preferred over the Niagara Falls options and LF-9C, although an overlap exists with the 5% error estimate. LF-4N/PI-1N marginally overlaps with LF-9C, LF-1E and LF-1E/PI-27E based on a 5% error estimate. LF-4N/PI-13N is considerably less attractive than the other five siting options.

Figure 7.3
Quantitative Aggregation of Risk Factors



HBS = HYPOTHETICAL BEST SITING OPTION

7.3.2 IMPACT FACTORS

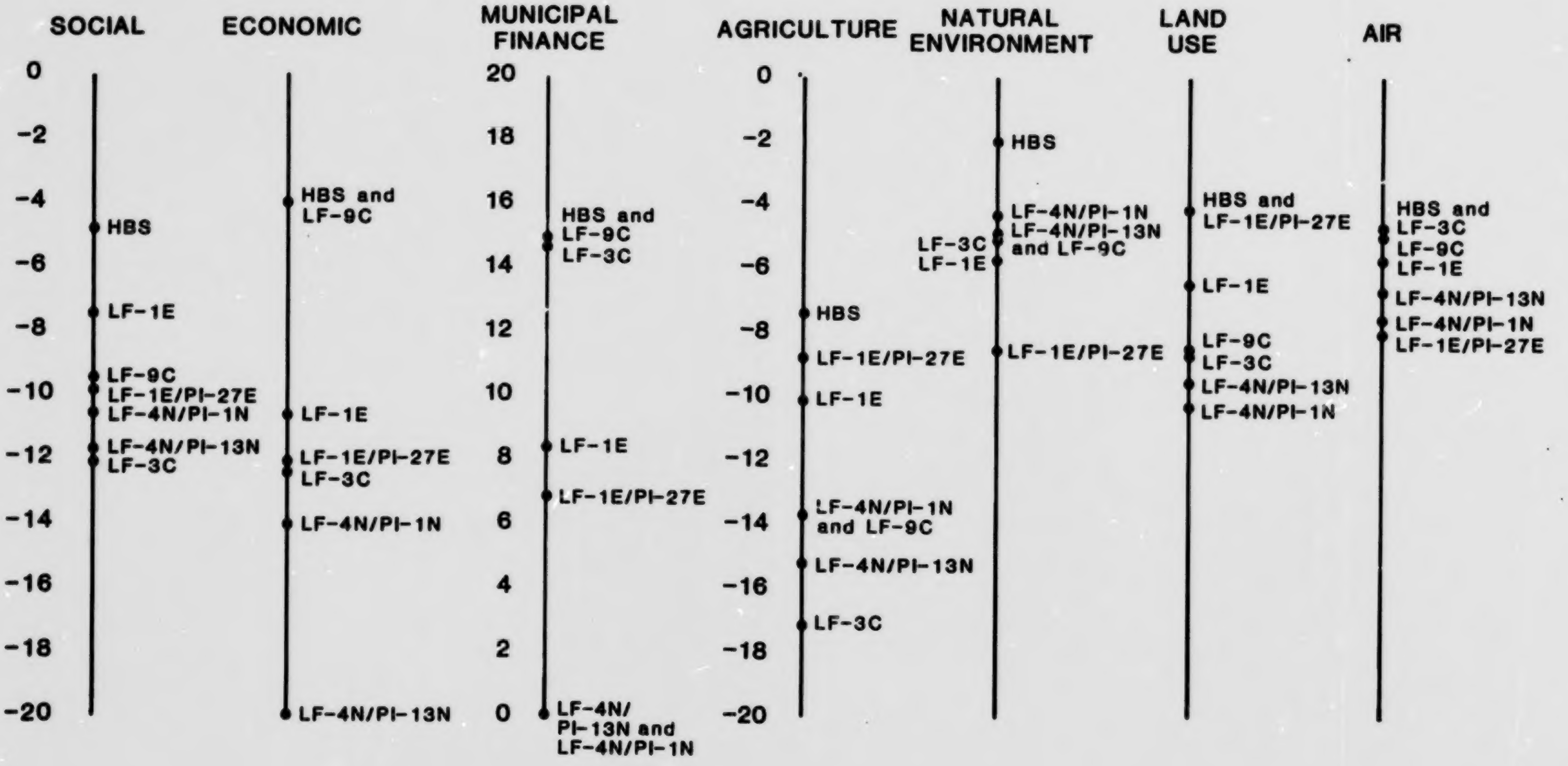
a) Individual Disciplines and Study Areas

Figures 7.4 and 7.5 present the results of the quantitative aggregation of impact factors by study area and by discipline. The hypothetical best siting option is also plotted to provide a bench-mark against which the siting options can be compared. The impact factors were combined on both a disciplinary and a study area basis. These two procedures parallel the disciplinary synthesis and the difference and tradeoff synthesis by study area.

The results of the two quantitative analyses are slightly different because each approach emphasizes different characteristics of the siting options. Combining impact factors by discipline emphasizes tradeoffs across rather than within disciplines. Only one value for each discipline is used to compare siting options. There are several socio-economic (five out of seven) disciplines. Consequently, the natural environment discipline receives less weight in the analysis. Similarly, more than one socio-economic discipline addresses the same or similar impacts. For example, stability is addressed by the social, land use and agricultural consultants, each from their own perspective. Similarly, various impacts on adjacent residents are addressed by these three consultants (e.g. nuisance impacts on adjacent residents, land use and farms).

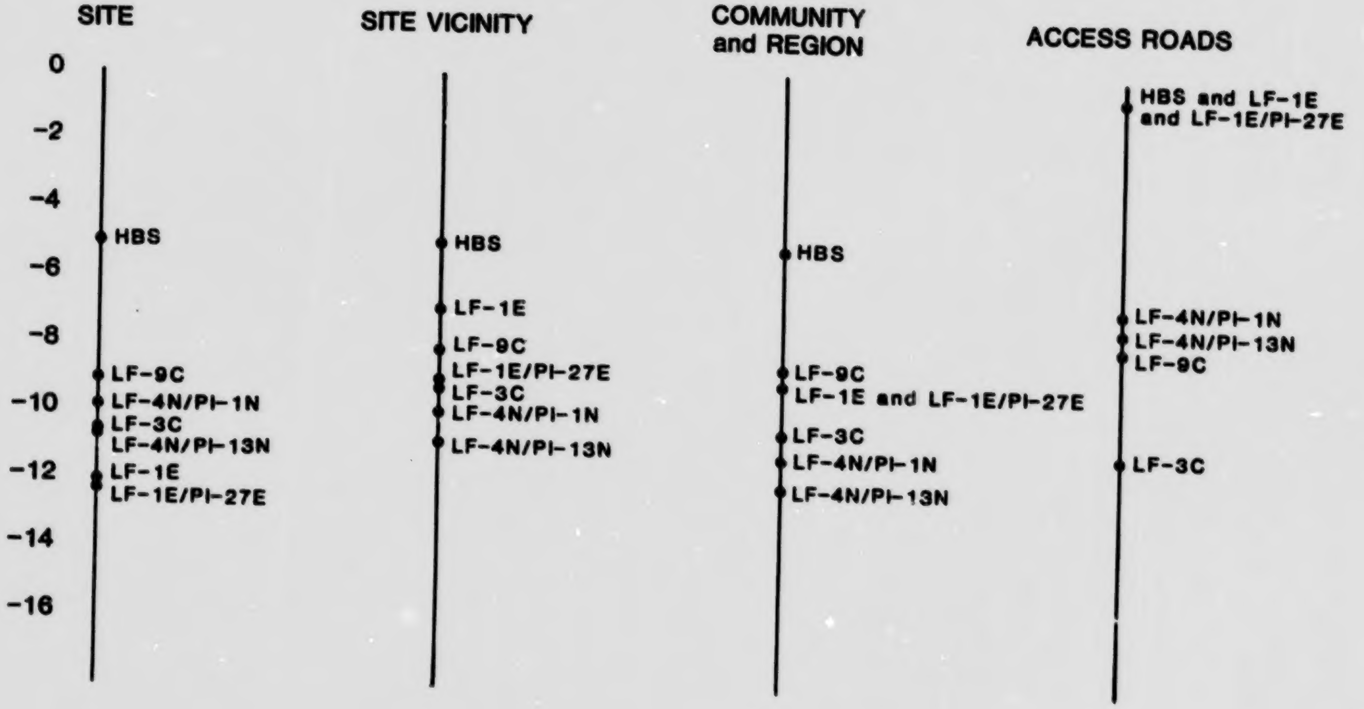
Combining factors by study area reduces some of the overlaps noted above. By focusing on individual factors for each study area, the major tradeoffs within disciplines are apparent. Double-counting of impacts is also reduced because the disciplinary perspectives reinforce one another within each study area. Major tradeoffs within study areas, however receive less emphasis with this procedure. In addition, in some instances the same impacts, e.g. provincial policies and plans, are addressed in two study areas, e.g. site vicinity and community and regional.

Figure 7.4
QUANTITATIVE ANALYSIS
Aggregation of Impact Factors by Discipline



HBS = HYPOTHETICAL BEST SITING OPTION

Figure 7.5
QUANTITATIVE ANALYSIS
Aggregation of Impact Factors by Study Area



HBS = HYPOTHETICAL BEST SITING OPTION

The following general patterns are evident from Figure 7.4 - Aggregation of Impact Factors By Discipline:

- None of the six siting options is very close to the hypothetical best siting option for the social discipline. There is a clear difference between LF-1E, the preferred siting option, from a social perspective and the remaining five siting options, all of which are grouped quite close together.

- LF-9C coincides with the hypothetical best siting option for the economic discipline. LF-9C is rated much more favourably than the remaining siting options. LF-4N/PI-13N is the least favoured siting option by a wide margin. The remaining siting options are grouped relatively close together in the intermediate range. Only a slight difference between LF-1E/PI-27E and LF-3C is evident.

- LF-9C also coincides with the hypothetical best siting option for the municipal finance discipline. There is a wide margin between LF-9C and the two intermediate-rated options - LF-1E and LF-1E/PI-27E. The differences between the two Niagara Falls options are quite limited. There is a further wide margin between the Niagara Falls options and the two Milton siting options. There is essentially no difference between the two Milton siting options.

- LF-1E/PI-27E and LF-1E are relatively close to the hypothetical best siting option from an agricultural perspective. There are limited differences between the two Niagara Falls options. There is a wide gap between LF-1E/PI-27E and LF-1E and the remaining four siting options. LF-4N/PI-1N and LF-9C are rated as approximately equivalent. LF-4N/PI-13N is rated moderately less favourably than LF-4N/PI-1N and LF-9C. LF-3C is, in turn, rated moderately less favourable than LF-3C.

- Five of the six siting options are grouped close together for the natural environment discipline. There is a moderate separation between the five siting options and the hypothetical best siting option. The sixth ranked option, LF-1E/PI-27E is clearly less preferred than the other siting options.

- LF-1E/PI-27E coincides with the hypothetical best siting option for the land use discipline. LF-1E is moderately less preferred than LF-1E/PI-27E. The remaining four siting options are closely grouped and clearly less preferred than the Niagara Falls siting options.

- All six options are grouped quite closely together for the air impact discipline. The two West Lincoln siting options are favoured. LF-1E/PI-27E is the least preferred siting option. None of the siting options is well removed from the hypothetical best siting option.

The following general patterns are evident from a review of Figure 7.5 - Aggregation of Impact Factors by Study Area:

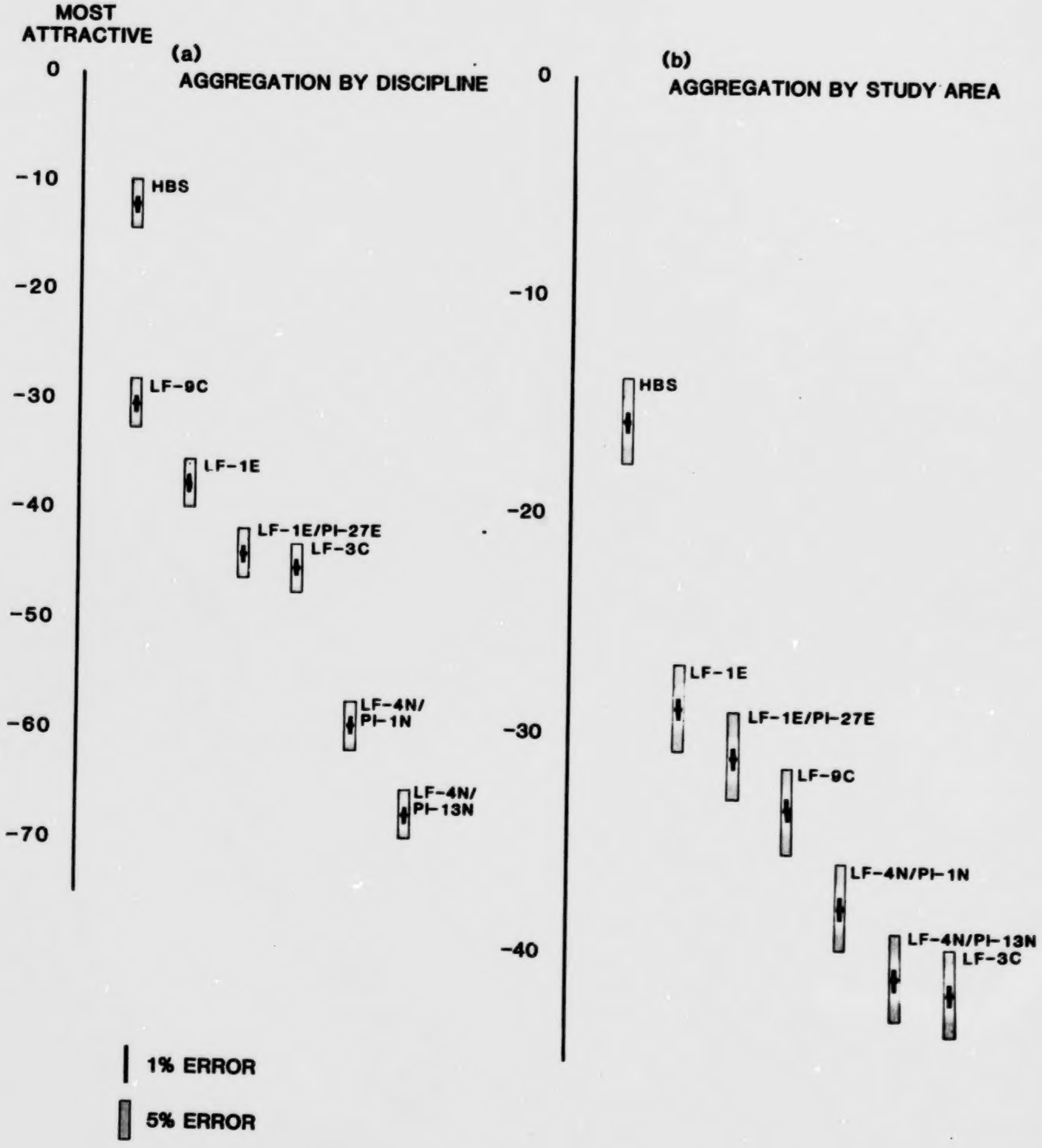
- The six siting options are grouped closely together for the site study area. There is a clear gap between the hypothetical best siting option and the six siting options. LF-9C is the preferred siting option. LF-1E/PI-27E is the least preferred siting option.

- The six siting options are also grouped closely together for the site vicinity study area with a moderate gap between the preferred siting option LF-1E and the hypothetical best siting option. LF-9C and the two Niagara Falls siting options are preferred to the Milton siting options. The difference between LF-3C and LF-1E/PI-27E is very slight.

- The six siting options are grouped very closely together for the community and regional study area. There is a clear gap between the hypothetical best siting option and the six siting options. LF-9C and

Figure 7.6

Quantitative Aggregation of Impact Factors



HBS = HYPOTHETICAL BEST SITING OPTION

the two Niagara Falls siting options (LF-1E and LF-1E/PI-27E) are again preferred to LF-3C in West Lincoln and to the two Milton siting options.

- LF-1E and LF-1E/PI-27E virtually coincide with the hypothetical best siting option for access road impacts. There is a clear gap between the two Niagara Falls siting options and the three intermediate-rated siting options - LF-9C, LF-4N/PI-1N and LF-4N/PI-13N. The latter three options are grouped quite closely together with LF-9C preferred. There is a further wide gap between these intermediate-rated siting options and the least preferred siting option - LF-3C in West Lincoln.

b) **Combined Disciplines and Study Areas**

Figure 7.6 presents the results of the aggregation by discipline and by study area.

Using a 1% error estimate, the following ranking results from the disciplinary aggregation:

1. LF-9C;
2. LF-1E;
3. LF-1E/PI-27E;
4. LF-3C;
5. LF-4N/PI-1N;
6. LF-4N/PI-13N.

The difference between LF-1E/PI-27E and LF-3C is not significant using a 5% error estimate.

The general patterns, illustrated in Figure 7.6, include the following:

- There is a clear separation between the hypothetical best siting option and the six siting options.

- There are moderate, but clear gaps between LF-9C, LF-1E, and LF-1E/PI-27E, with LF-3C. There is a very limited difference between LF-1E/PI-27E and LF-3C.

- There is a somewhat wider gap between the four most highly ranked options and the two Milton siting options. There is a moderate difference between the Milton siting options.

Using a 1% error estimate, the following ranking results from the study area aggregation:

1. LF-1E;
2. LF-1E/PI-27E;
3. LF-9C;
4. LF-4N/PI-1N;
5. LF-4N/PI-13N;
6. LF-3C.

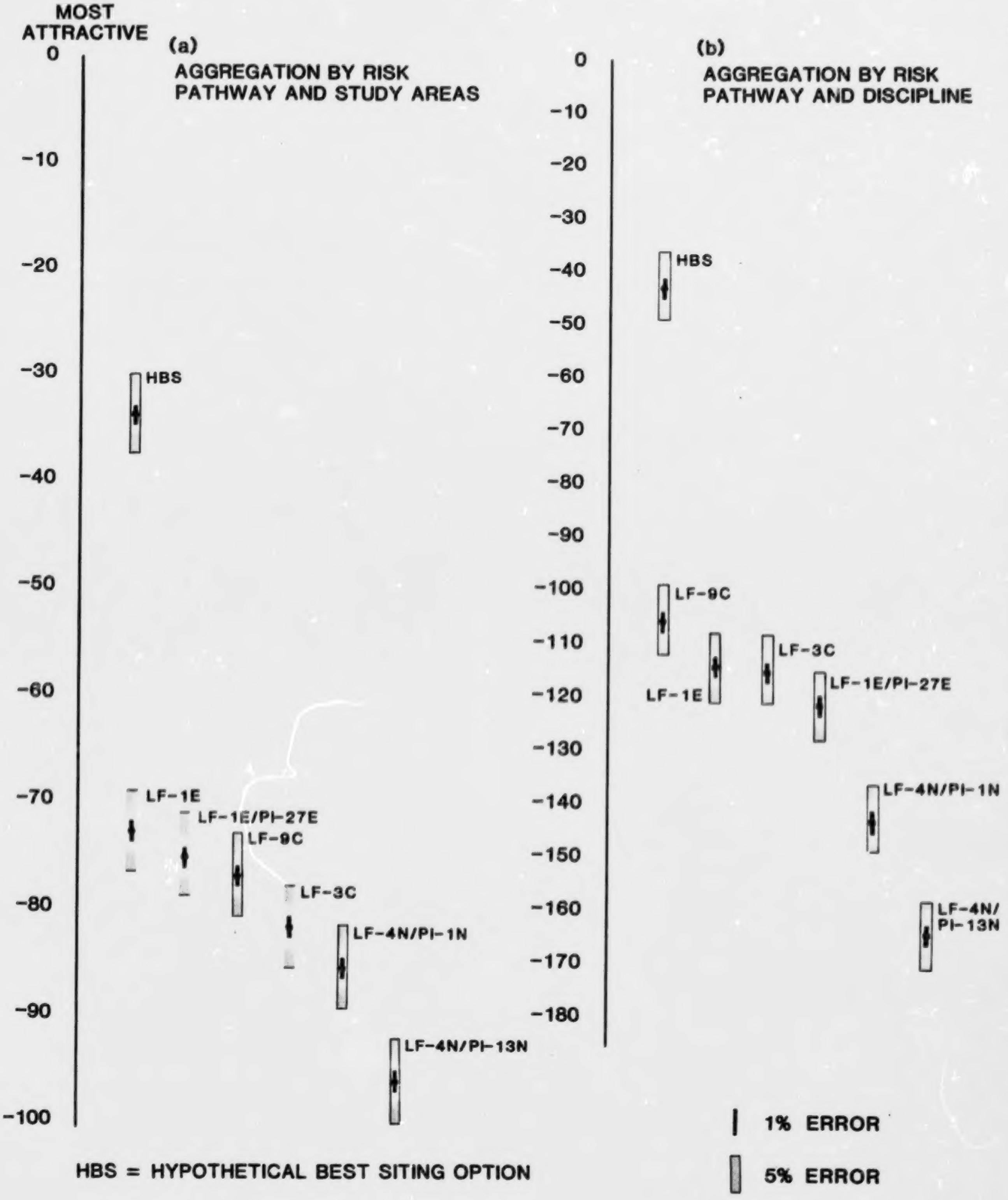
Using a 5% error estimate, the options are separated into two groups with LF-1E, LF-1E/PI-27E and LF-9C most preferred and LF-4N/PI-1N, LF-4N/PI-13N and LF-3C least preferred. There are only minor overlaps in the range of values, including error, for all siting options except LF-3C and LF-4N/PI-13N which receive very similar scores. All six siting options are clearly separated from the hypothetical best siting option.

7.3.3 COMBINED RISKS AND IMPACTS

Figure 7.7 shows the ranking of siting options which emerges when risks and impacts are combined.

Figure 7.7

Quantitative Aggregation of Risk and Impact Factors Combined



HBS = HYPOTHETICAL BEST SITING OPTION

When risk factors are aggregated by pathway and impact factors by study area (Figure 7.7a) the following ranking, including 1% error, results:

1. LF-1E;
2. LF-1E/PI-27E and LF-9C;
3. LF-3C;
4. LF-4N/PI-1N;
5. LF-4N/PI-13N.

When a 5% error is applied, LF-1E, LF-1E/PI-27E and LF-9C are essentially equal. LF-3C is less attractive than the Niagara Falls options, but overlaps with LF-9C and LF-4N/PI-1N. Similarly, LF-4N/PI-1N is less attractive than the Niagara Falls options and LF-9C, but overlaps with LF-3C. LF-4N/PI-13N is clearly least preferred.

When impact and risk factors are aggregated by discipline/pathway (Figure 7.7b), and based on a 1% error estimate, the following ranking results:

1. LF-9C;
2. LF-1E and LF-3C;
3. LF-1E/PI-27E;
4. LF-4N/PI-1N;
5. LF-4N/PI-13N.

When a 5% error is applied, the Niagara Falls and West Lincoln options are not significantly different, although LF-1E/PI-27E is less attractive than LF-9C. The two Milton options are clearly less preferred. LF-4N/PI-13N is clearly less preferred than LF-4N/PI-1N.

7.4 CONCLUSIONS

In reviewing the analyses, the following general conclusions are evident:

- The two Milton siting options appear clearly as the least preferred.
- The differences among the four remaining siting options are quite limited. The selection of a preferred siting option, from among these siting options, is dependent upon such considerations as:
  - the method of aggregation employed;
  - the weight placed upon individual risks and impacts;
  - the weight placed upon risks as compared with impacts.
- In view of the potential for varying many of the inputs into the quantitative aggregation, it would be preferable to consider the top four ranked siting options further on the basis of a range of sensitivity analyses (see Chapter 8).

8.0 SENSITIVITY ANALYSES

8.1 INTRODUCTION

This chapter documents a series of analyses undertaken to test the sensitivity of siting option rankings to alternative assumptions regarding:

- facility characteristics;
- future conditions and study area boundaries;
- risk and impact predictions;
- mitigation and compensation measures;
- factor and factor grouping weights.

8.1.1 RELATIONSHIP TO OTHER CHAPTERS AND REPORTS

The sensitivity analyses contained in this chapter synthesize a number of sensitivity analyses addressed by individual site selection consultants[1]. Sensitivity analyses addressed by more than one site selection consultant are included. Sensitivity analyses addressed by one site selection consultant were included if siting option rankings were changed or if differences among siting options were appreciably altered. In addition, a range of sensitivity analyses undertaken by, or coordinated by, the site selection coordinating consultant, M.M. Dillon Ltd. are included.

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[1] Reference should be made to the reports of the individual site selection consultants for details of their sensitivity analyses.

These sensitivity analyses address a range of matters potentially subject to change or alternative interpretation. They represent a cross-check of data, interpretations and conclusions addressed in factor ranking (Chapter 4) and in siting option comparison (Chapters 5, 6 and 7).

The sensitivity analyses, where possible, extend from the Quantitative Aggregation documented in Chapter 7. Factors have been deleted or grouped in different ways. Factor weights, suitability levels and scores have also been adjusted. The bases for these changes are the analyses and interpretations addressed elsewhere in Volumes 1 and 2 as well as in other site selection consultants reports.

Not all the sensitivity analyses were addressed quantitatively. In a number of instances, it was only possible to adjust siting option rankings or the differences between siting options in a qualitative manner. These qualitative adjustments also drew upon analyses and interpretations contained elsewhere in this report and in other site selection reports.

In addition to the above, a number of the sensitivity analyses addressed in this chapter were a consequence of comments and suggestions obtained through the OWMC agency and public consultation program.

This chapter applies the sensitivity analyses to the siting option rankings. Background information on the matters and options addressed by the sensitivity analyses, notably the partial versus total solidification* analysis, are contained in Appendix G.

8.1.2 CHAPTER FORMAT

The chapter begins with a description of the sensitivity analyses approach (Section 8.2). The sensitivity analyses process is presented and the assumptions are listed. The general procedures employed in the sensitivity analyses are described. A step-by-step procedure for identifying, applying and interpreting the sensitivity analyses is presented (Section 8.3). Overall conclusions are then presented. (Section 8.4)

8.2 APPROACH

8.2.1 SENSITIVITY ANALYSES PROCESS

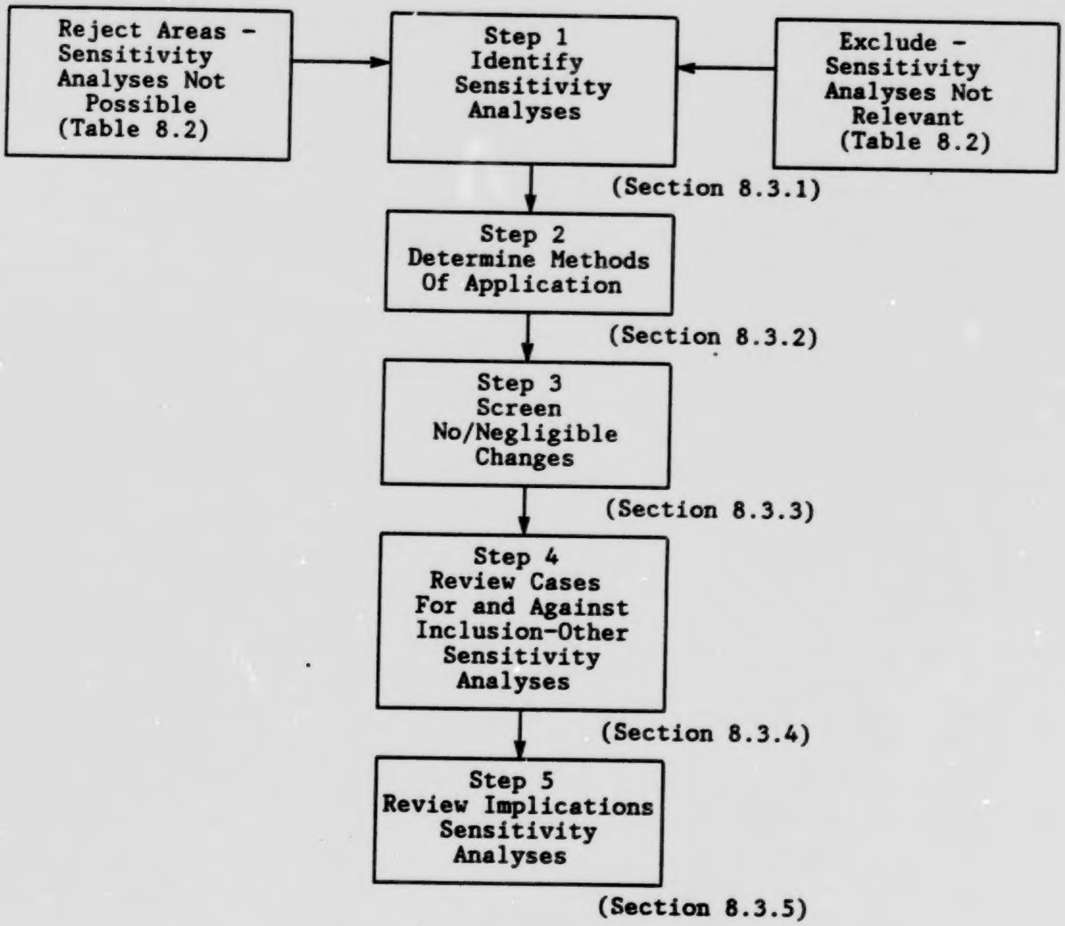
The sensitivity analyses process is depicted in Figure 8.1. The process began with a review of potential sensitivity analyses. However, many of the potential sensitivity analyses were not considered because they were not possible as support data or interpretations were not available, there was no basis for altering assumptions or weights, or it was not possible specify direction and/or magnitude of change. In addition, sensitivity analyses were not undertaken where changes were very limited, the change was no longer relevant to the comparative evaluation or the change did not contribute to the comparison of the four most highly ranked options.

Appropriate methods of applying each sensitivity analysis were then determined. In some instances, the methods involved a quantitative adjustment to the data, the factor rankings, the suitability levels or the factor scores. In other cases, qualitative procedures were employed to alter siting option rankings or to indicate the direction of change in rankings.

Once methods were determined, the sensitivity analyses were undertaken. In many cases, the outcome of the sensitivity analyses was no change in the siting option rankings and no or minor change in the difference between or among siting options. These latter sensitivity analyses were screened from further consideration.

FIGURE 8.1

Sensitivity Analyses Process


Reject Areas - Sensitivity Analyses Not Possible (Table 8.2)
Step 1 Identify Sensitivity Analyses
Exclude - Sensitivity Analyses Not Relevant (Table 8.2)
(Section 8.3.1)
Step 2 Determine Methods Of Application
(Section 8.3.2)
Step 3 Screen No/Negligible Changes
(Section 8.3.3)
Step 4 Review Cases For and Against Inclusion-Other Sensitivity Analyses
(Section 8.3.4)
Step 5 Review Implications Sensitivity Analyses
(Section 8.3.5)

8.2.2 ASSUMPTIONS

The following assumptions were employed in undertaking the sensitivity analyses:

- Sensitivity analyses were undertaken to enhance the comparative evaluation of siting options. Areas of potential uncertainty or subject to conflicting interpretations were only addressed through sensitivity analyses if they could contribute to the comparative evaluation of siting options.

- The sensitivity analyses represent an extension of the siting option comparisons detailed in Chapters 5, 6 and 7. Sensitivity analyses were only undertaken where Phase 4A engineering, site selection, and OWMC policies, data and analyses permitted the application of such analyses.

- In each case, an effort was made to define and substantiate the limits of variability. Where the limits of variability could not be specified, an effort was made to define and substantiate the direction and nature of potential changes in siting option rankings. If the direction of change could not be determined, a sensitivity analysis was not undertaken.

- The comparative analyses detailed in Chapters 5, 6, and 7 resulted in the overall conclusion that the two Milton siting options, LF-4N/PI-1N and LF-4N/PI-13N, were clearly less preferred than the West Lincoln and Niagara Falls options. The sensitivity analyses have, therefore, focused on assumptions and weighting changes pertinent to the comparison of the four West Lincoln and Niagara Falls siting options. However, a selective number of sensitivity analyses were undertaken which were pertinent to the major advantages and disadvantages of the Milton siting options.

- The sensitivity analyses undertaken by an individual consultant were not included unless they resulted in alterations in siting option rankings or in appreciable changes in the magnitude of difference between siting options.

- The sensitivity analyses have not generally been carried out at the same level of detail as the analyses using the base case assumptions. These sensitivity analyses are adequate for the purpose of testing the siting option rankings. However, refinements in the level of detail should occur before base case assumptions are modified.

- The sensitivity analyses address potential risks and impacts. The role of cost and engineering flexibility considerations in tempering siting option rankings has already been addressed in Chapters 5 and 6. As previously noted, cost is the lowest ranked OWMC goal and the engineering/cost differences among the siting options are limited.

8.2.3 PROCEDURES AND FORMAT

Each of the steps in the sensitivity analyses have been summarized through the use of tables and figures supplemented by explanatory text. Interpretations and conclusions are highlighted together with supporting reasons.

The distinction between quantitative and qualitative sensitivity analyses is maintained throughout the process. Alternative assumptions regarding facility characteristics, future conditions and study area boundaries, risk and impact predictions, mitigation and compensation measures, and factor and factor grouping weights are also generally addressed separately. Within these distinctions, risks and impacts are initially addressed separately before being combined.

The procedures employed in each step of the sensitivity analysis process are detailed on a step-by-step basis.

8.3 SENSITIVITY ANALYSES

8.3.1 IDENTIFY SENSITIVITY ANALYSES

A broad range of possible sensitivity analyses were considered (see Table 8.1). Tables I.1 through I.5 in Appendix I list[1]:

- the possible sensitivity analyses considered;
- the "base case" assumptions as employed in the detailed comparative evaluation (Chapters 5, 6 and 7);
- the nature of the change that would occur under the sensitivity analyses; and

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[1] The following sensitivity analyses are listed in Table 8.1, but not in Tables I.1 through I.5; other changes in facilities characteristics assumptions, other changes in predicted risks, other changes in risk weights, other changes in risk mitigation, other changes in impact predictions, other changes in impact weights, other site vicinity impacts, other access road impacts, other community and regional impacts, other adjustments in impact prediction and other changes in time or space boundaries. These sensitivity analyses were intended to address all areas not addressed by Phase 4A sensitivity analyses. In all cases, there was no apparent basis for further sensitivity analyses. All of the above are subsequently excluded in Table 8.2.

TABLE 8.1

Sensitivity Analyses Considered

Facility Characteristics

- haul methods for additives and reagents (road vs. road and rail)
- waste quantities (150,000 t/a vs. 300,000 t/a)
- waste sources (Scenario 1 vs. Scenario 2)
- technology (partial vs. total solidification)
- stack height (60 m vs. 100 m)
- landfill type (conventional vs. shallow entombment)
- other changes in facilities characteristics assumptions

Risk Prediction

- indirect air risks
- chronic air risks
- susceptibility of site to flooding
- alternative dispersion climatologies
- other changes in predicted risks

Risk Weights

- direct and indirect chronic air
- local and regional and province-wide access routes
- transportation (less weight)
- transportation (greater weight)
- other changes in risk weights

Risk Mitigation

- susceptibility of site to flooding
- ground and surface water use
- acute air risks
- emergency back-up
- other changes in risk mitigation

Impact Prediction

- ability of community to cope with change
- less conservative approach - noise impacts - access roads
- industrial attraction differences
- if PI-1N selected by Region of Halton
- soil capability class revisions
- sensitive crop list
- larger negative property value and out-migration impacts
- other changes in impact predictions

TABLE 8.1 (cont'd)

Sensitivity Analyses Considered

Impact Weights

- industrial designation (greater weight)
- industrial designation (deleted for PI-27E) (lower weight)
- greater weight - displacement of farmland and farms (on-site and partial)
- less weight - air impacts
- greater weight - natural environmental factors - site and site vicinity
- business, agriculture, tourism components of economic base
- alternative positive and negative economic base factor weights
- reduced weights - community and regional and access road impacts
- alternative indicator and subindicator weights - economic base
- alternative weights for disciplines
- other changes in impact weights

Impacts - Mitigation and Compensation

- assume municipal services and municipal financial impact mitigable through compensation
- assume on-site impacts mitigable - businesses, residents, farms, natural features, land uses
- assume impacts on adjacent residents, community and recreation features and farms mitigable through property buy-out program
- assume site vicinity noise impacts largely mitigable (design and operations changes)
- assume property value impacts mitigable (property value protection program)
- assume natural environmental site vicinity impacts mitigable (design and operations, habitat creation and enhancement)
- assume entire site assessed as industrial land
- no payments-in-lieu of business taxes
- other site vicinity impacts
- other access road impacts
- other community and regional impacts
- other adjustments in impact mitigation

Future Conditions and Study Area Boundaries

- future scenarios
- construction impacts
- secondary access routes - West Lincoln
- definition of local and regional access roads - Niagara Falls
- transportation (receptors)

TABLE 8.1 (cont'd)

Sensitivity Analyses Considered

Future Conditions and Study Area Boundaries (cont'd)

- definition of local and regional access roads - Milton
- site vicinity boundary - LF-1E
- site boundaries - LF-3C and LF-1E (as part of LF-1E/PI-27E)
- other changes in time or space boundaries

Risks, Impacts and Costs

- greater weight - risks
- risks, impacts and costs
- cost - sensitivity analysis - cost estimates and discount rates
- costs - transport loading and unloading times

- the rationale regarding why the sensitivity analysis was identified for consideration.

These possible sensitivity analyses are grouped in the following manner:

- facility characteristics (Table I.1);
- risks (Table I.2):
  - predicted risks
  - risk weights
  - risk mitigation
- impacts (Table I.3):
  - predicted impacts
  - impact weights
  - impact mitigation
- future conditions and study area boundaries (Table I.4):
  - time
  - space
- risks, impacts and costs (Table I.5):
  - risks and impacts
  - risks, impacts and costs.

The major reasons why possible sensitivity analyses were excluded from further consideration included the following:

- not directly relevant to the comparative evaluation. Some possible sensitivity analyses had no bearing on the comparative evaluation of siting options because predicted risks, impacts or costs would either not change or the change would be negligible;

- support data or interpretation not available. In some cases, it was not possible to undertake a potential sensitivity analysis in even a very general manner because necessary engineering, environmental or policy inputs were not available;

- no longer relevant to comparative evaluation. As described in Chapter 3, facilities characteristics assumptions and OWMC policies evolved through the course of Phase 4A. Sensitivity analyses, which might have been relevant at one stage of Phase 4A, were, in some cases, no longer relevant by the end of Phase 4A;

- no basis for altering assumptions or weights. All sensitivity analyses were based on data or interpretative uncertainties. Sensitivity analyses were only undertaken if the nature and rationale for a potential change could be substantiated;

- not possible to specify direction and/or magnitude of change. Even if data or interpretative uncertainties could be identified (which would form the basis for a sensitivity analysis), the sensitivity analysis was only undertaken if the direction of change, i.e. increased or decreased risks or impacts could be indicated. Wherever possible, the magnitude of change, generally in the form of an upper or lower limit, was also specified;

- not relevant to the comparison of top ranked siting options. Sensitivity analyses generally serve to test whether potential changes in inputs to a comparative evaluation process might alter the ranking of closely ranked options. The comparative evaluation procedures, documented in Chapters 5, 6 and 7, resulted in a wide gulf between the Milton siting options and the preferred siting options. The sensitivity analyses, therefore, focused on the four most highly ranked options - LF-3C and LF-9C in West Lincoln and LF-1E and LF-1E/PI-27E. Sensitivity analyses involving the Milton siting options were undertaken where they had a bearing on the major relative advantages and disadvantages of these options;

- adequately addressed elsewhere. In some instances, possible sensitivity analyses were fully and adequately addressed either in the report of a single site selection consultant or elsewhere in this report. Such sensitivity analyses have not been included.

The rationale for the possible sensitivity analyses which were excluded is provided in Table 8.2. Whether the sensitivity analyses were included or excluded are listed in Table 8.3.

8.3.2 DETERMINE METHODS OF APPLICATION

Both qualitative and quantitative procedures were employed to undertake the sensitivity analysis. The qualitative procedures involved subjective interpretations of the general direction of change, the general magnitude of change (where possible) and the likely implications for siting option rankings. The interpretation of implications, in most instances, meant pointing out whether siting option rankings would change. It also meant, to the extent possible, indicating whether the change would close or widen the gap (in a minor or substantial way) between the attractiveness of siting options.

The quantitative procedures involved a range of adjustments to the quantitative aggregation analysis presented in Chapter 7. The major types of changes included:

- modifying factor suitability levels on the basis of data changes;
- deleting factors;
- changing factor weights.

With both the quantitative and the qualitative procedures an effort was made to build upon the analyses undertaken by the other site selection consultants.

TABLE 8.2

Potential Sensitivity Analyses Excluded

AREAS - POTENTIAL SENSITIVITY ANALYSES	REASONS FOR EXCLUSION								RATIONALE - POSSIBLE/RELEVANT
	1	2	3	4	5	6	7	8	
Facility Characteristics									
° Other changes in facilities characteristics assumptions		0		0	0				° no other facility characteristics where data available where options would be identified or where associated risks and impacts would be specified
Risks									
° Alternative dispersion climatologies								0	° affects only one consultant - Ontario Research Foundation (ORF) ° fully addressed in ORF report
° Other changes in predicted risks		0		0	0				° no further basis for altering risk prediction or of establishing thresholds for consideration
° Other changes in risk weights		0		0	0				° no basis for further changes in weights; other possible and relevant changes addressed by risk predictions and mitigation sensitivity analyses
° Emergency back-up	0		0						° OWMC commitment to ensure adequate emergency response capability for all options; if response capability not adequate, OWMC will bring up to appropriate standard
° Other changes in risk mitigation		0		0	0				° no further basis for adjusting factor weights or suitability levels on the basis of mitigation

Legend:

1. Not directly relevant to comparative evaluation.
2. Support data or interpretation not available.
3. No longer relevant to comparative evaluation; superceded by revised data interpretations or policies.
4. No basis for altering assumptions or weights.
5. Not possible to specify direction and/or magnitude of change.
6. Not relevant to comparison of top four ranked siting options.
7. Not a major consideration in Milton siting option rankings.
8. Adequately addressed by single consultant; no overall implications.

TABLE 8.2

Potential Sensitivity Analyses Excluded

AREAS - POTENTIAL SENSITIVITY ANALYSES	REASONS FOR EXCLUSION								RATIONALE - POSSIBLE/RELEVANT
	1	2	3	4	5	6	7	8	
Impacts									
° Industrial attraction differences								0	° economic analysis suggested limited potential for facility to draw in industrial uses ° to the extent that occurs, possible to prevent or direct through land use controls ° spin-off employment potential fully addressed by Economic Base consultant - no change in siting option (Clayton Research Associates, 1985b) ranking or appreciable change in magnitude of difference among siting options
° If PI-1N selected by Region of Halton						0	0		° no affect on ranking of West Lincoln and Niagara Falls siting options ° minimal effect on position of Halton options relative to West Lincoln and Niagara Falls options
° Soil capability class revisions								0	° affects only one site selection consultant ° no change in siting option rankings ° negligible change in magnitude of differences among siting options ° fully addressed in agricultural report (Ecologistics, 1985)
° Sensitive crop list								0	° affects only one site selection consultant ° no change in siting option rankings or in magnitude of difference among siting options ° fully addressed in agricultural report (Ecologistics, 1985)

Legend:

1. Not directly relevant to comparative evaluation.
2. Support data or interpretation not available.
3. No longer relevant to comparative evaluation; superceded by revised data interpretations or policies.
4. No basis for altering assumptions or weights.
5. Not possible to specify direction and/or magnitude of change.
6. Not relevant to comparison of top four ranked siting options.
7. Not a major consideration in Milton siting option rankings.
8. Adequately addressed by single consultant; no overall implications.

TABLE 8.2

Potential Sensitivity Analyses Excluded

AREAS - POTENTIAL SENSITIVITY ANALYSES	REASONS FOR EXCLUSION								RATIONALE - POSSIBLE/RELEVANT
	1	2	3	4	5	6	7	8	
Impacts (cont'd)									
° Other changes in impact predictions		0		0	0				° no further basis for adjusting impact predictions or of establishing thresholds for considerations
° Alternative indicator and subindicator weights - economic base								0	° affects only one consultant - Clayton Research Associates ° other site selection consultants fully responsible for indicators and subindicators ° fully addressed in economic base report (Clayton Research Associates Ltd., 1985b)
° Alternative weights for disciplines				0	0				° no basis for altering weights ° weights for disciplines addressed on an individual factor basis; variations within disciplines (among factors) in terms of importance too broad to weight disciplines as a whole
° Other changes in impact weights		0		0	0				° no basis for further changes in weights; other possible and relevant changes addressed by impact prediction and mitigation sensitivity analyses
° No payment-in-lieu of business taxes			0					0	° contrary to OWMC policy - no municipality will suffer financially; current policy that payments-in-lieu of business taxes will be paid; does not alter overall ranking of siting options or appreciably change magnitude of difference among options; adequately addressed in Municipal Finance report (Clayton Research Associates, 1985)

Legend:

1. Not directly relevant to comparative evaluation.
2. Support data or interpretation not available.
3. No longer relevant to comparative evaluation; superceded by revised data interpretations or policies.
4. No basis for altering assumptions or weights.
5. Not possible to specify direction and/or magnitude of change.
6. Not relevant to comparison of top four ranked siting options.
7. Not a major consideration in Milton siting option rankings.
8. Adequately addressed by single consultant; no overall implications.

TABLE 8.2

Potential Sensitivity Analyses Excluded

AREAS - POTENTIAL SENSITIVITY ANALYSES	REASONS FOR EXCLUSION								RATIONALE - POSSIBLE/RELEVANT
	1	2	3	4	5	6	7	8	
Impacts (cont'd)									
° Other site vicinity impacts		0		0	0				° not possible to specify direction and/or magnitude of change; magnitude, nature and mitigation potential highly dependent on perceptions and attitudes; range of potential effects, e.g. noise, visual intrusion, perceived risks - difficult to mitigate perceived cumulative impacts; no directly applicable mitigation measures or compensation policies
° Other access road impacts		0		0	0				° as OWMC traffic generally a small proportion of total traffic - mitigation measures will, for the most part, not be introduced; not possible to specify if and extent to which may be introduced
° Other community and regional impacts		0		0	0				° not possible to specify direction and/or magnitude of change; impacts quite dependent on perceptions and attitudes which are difficult to predict; no directly applicable mitigation measure or compensation policy
° Other adjustments in impact mitigation		0		0	0				° no further basis for adjusting factor weights or suitability levels on the basis of mitigation
Future Conditions and Study Area Boundaries									
° Definition of local and regional roads - Milton						0			° no affect on ranking of West Lincoln and Niagara Falls siting options ° Milton options - addressed through sensitivity analysis - greater weight - transportation risks

Legend:

1. Not directly relevant to comparative evaluation.
2. Support data or interpretation not available.
3. No longer relevant to comparative evaluation; superceded by revised data interpretations or policies.
4. No basis for altering assumptions or weights.
5. Not possible to specify direction and/or magnitude of change.
6. Not relevant to comparison of top four ranked siting options.
7. Not a major consideration in Milton siting option rankings.
8. Adequately addressed by single consultant; no overall implications.

TABLE 8.2

Potential Sensitivity Analyses Excluded

AREAS - POTENTIAL SENSITIVITY ANALYSES	REASONS FOR EXCLUSION								RATIONALE - POSSIBLE/RELEVANT
	1	2	3	4	5	6	7	8	
Future Conditions and Study Area Boundaries (cont'd)									
° Site boundaries - LF-3C and LF-1E			0						° subsequent to the completion of sensitivity analysis, landfill life estimates were revised to include Phase 4A hydrogeologic information. Landfill lives for both siting options were less than 20 years (considered minimal practical size) with original boundaries. Alternatives to boundaries would reduce landfill lives further
° Other changes in time or space boundaries		0		0	0				° no basis for further changes
° Site vicinity boundary - LF-1E								0	° undertaken by only one site selection consultant ° no change in siting option rankings ° fully addressed in economic base report (Clayton, 1985a)
Risks, Impacts and Costs									
° Risks, impacts and costs	0							0	° cost estimate differences among siting options within margin of error of estimate ° cost and engineering flexibility differences addressed adequately qualitatively in Chapters 5 and 6 ° costs - lowest ranked goal
° Cost - sensitivity analysis - cost estimates and discount rates								0	° fully addressed in Phase 4A engineering report (Monenco Ltd., 1986)

Legend:

1. Not directly relevant to comparative evaluation.
2. Support data or interpretation not available.
3. No longer relevant to comparative evaluation; superceded by revised data interpretations or policies.
4. No basis for altering assumptions or weights.
5. Not possible to specify direction and/or magnitude of change.
6. Not relevant to comparison of top four ranked siting options.
7. Not a major consideration in Milton siting option rankings.
8. Adequately addressed by single consultant; no overall implications.

TABLE 8.2

Potential Sensitivity Analyses Excluded

AREAS - POTENTIAL SENSITIVITY ANALYSES	REASONS FOR EXCLUSION								RATIONALE - POSSIBLE/RELEVANT
	1	2	3	4	5	6	7	8	
Risks, Impacts and Costs (cont'd)									
° Transport - loading and unloading times								0	° only relevant to cost; fully addressed in M.M. Dillon Transportation report (M.M. Dillon Ltd., 1985b)

Legend:

1. Not directly relevant to comparative evaluation.
2. Support data or interpretation not available.
3. No longer relevant to comparative evaluation; superceded by revised data interpretations or policies.
4. No basis for altering assumptions or weights.
5. Not possible to specify direction and/or magnitude of change.
6. Not relevant to comparison of top four ranked siting options.
7. Not a major consideration in Milton siting option rankings.
8. Adequately addressed by single consultant; no overall implications.

TABLE 8.3

Sensitivity Analyses - Included or Excluded

SENSITIVITY ANALYSES - INCLUDED	SENSITIVITY ANALYSES - EXCLUDED
Facility Characteristics	
° haulage methods for additives and reagents (road vs. road and rail) ° waste quantities (150 000 t/a vs. 300 000 t/a) ° waste sources (Scenario 1 vs. Scenario 2) ° technology (total solidification vs. partial solidification) ° stack height (60 metres vs. 100 metres) ° landfill type (conventional vs. shallow entombment)	° other changes in facilities characteristics assumptions
Risks Prediction	
° indirect air risks ° chronic air risks ° susceptibility of site to flooding	° alternative dispersion climatologies ° other changes in predicted risks
Risk Weights	
° direct and indirect chronic air ° local and regional and province-wide access routes ° transportation (less weight) ° transportation (greater weight)	° other changes in risk weights
Risk Mitigation	
° susceptibility of site to flooding ° ground and surface water use ° acute air risk ° acute and chronic air risks	° emergency back-up ° other changes in risk mitigation

TABLE 8.3

Sensitivity Analyses - Included or Excluded

SENSITIVITY ANALYSES - INCLUDED	SENSITIVITY ANALYSES - EXCLUDED
Impact Prediction ° ability of community to cope with change ° less conservative approach - noise impacts - access roads ° larger negative property value and out-migration impacts	° industrial attraction differences ° if PI-1N selected by Region of Halton ° soil capability class revisions ° sensitive crop list ° other changes in impact predictions
Impact Weights ° industrial designation (greater importance) ° industrial designation (deleted for PI-27E) (lower weight) ° greater weight - displacement of farmland and farms (on-site and partial) ° less weight - air impacts ° greater weight - natural environmental factors - site and site vicinity ° business, agriculture, tourism components of economic base ° alternative positive and negative economic base factors weights ° reduced weights - community and regional and access road weights	° alternative indicator and subindicator weights - economic base ° alternative weights for disciplines ° other changes in impact weights
Impacts - Mitigation and Compensation ° assume municipal services and municipal financial impacts mitigable through compensation ° assume on-site impacts mitigable - residents, farms, natural features, land use ° assume impacts on adjacent residents, community and recreation features, and farms mitigable through property buy-out program	° no payment-in-lieu of business taxes ° other site vicinity impacts ° other access road impacts ° other community and regional impacts ° other adjustments in impact mitigation

TABLE 8.3

Sensitivity Analyses - Included or Excluded

SENSITIVITY ANALYSES - INCLUDED	SENSITIVITY ANALYSES - EXCLUDED
Impacts - Mitigation and Compensation (cont'd) ° assume site vicinity noise impacts largely mitigable (design and operations changes) ° assume property value impacts mitigable (property value protection program) ° assume natural environmental site vicinity impacts mitigable (design and operations, habitat creation and enhancement) ° assume entire site assessed as industrial land	
Future Conditions and Study Area Boundaries ° future scenarios ° construction impacts ° secondary access routes - West Lincoln ° definition of local and regional roads - Niagara Falls ° transportation (receptors)	° definition of local and regional access roads - Milton ° site vicinity boundary - LF-1E ° site boundaries - LF-3C and LF-1E (as part of LF-1E/PI-27E) ° other changes in time or space boundaries
Risks, Impacts and Costs ° greater weight - risks ° greater weight - impacts	° risks, impacts and costs ° cost - sensitivity analyses - cost estimates and discount rates ° transport - transport loading and unloading times

The method of application for each sensitivity analysis undertaken is described in Table I.6 in Appendix I, together with a supporting rationale.

8.3.3 SCREENING OF SENSITIVITY ANALYSES WITH NO OR NEGLIGIBLE CHANGE

a) Introduction

This step screened sensitivity analyses having no or negligible changes to the base case.

A series of screening criteria were developed and applied to each sensitivity analysis. These criteria include:

- no change to ranking of siting options and negligible magnitude of difference changes;
- largely addressed by other sensitivity analyses;
- uncertainties re: results/prediction;
- additional data and analysis required to confirm conclusions;
- changes will not help to distinguish among LF-9C, LF-3C, LF-1E and LF-1E/PI-27E;
- all options change in some direction by approximately the same amount. No change in ranking;
- degree of change in factor weight or factor suitability level cannot be supported;
- negligible changes in factor scores. No change in ranking.

b) Screening of Sensitivity Analyses

Table 8.4 lists sensitivity analyses screened together with the rationale for screening. The table presents both quantitative and qualitative sensitivity analyses.

TABLE 8.4

Screening of Sensitivity Analyses with No or Negligible Change

SENSITIVITY ANALYSES	REASONS FOR EXCLUSION								COMMENTS AND CONCLUSIONS
	1	2	3	4	5	6	7	8	
Facility Characteristics									
° Waste quantities (300,000 t/a vs. 150,000 t/a)	0				0				° very slight magnitude change
° Waste Sources (Scenario 1 vs. Scenario 2)		0							° no change in ranking of siting options ° unable to determine precise magnitude of difference changes ° addressed by sensitivity analysis which gives greater weight to transportation risks
° Technology (total vs. partial solidification)	0		0	0					° some uncertainty regarding off-site air risks and impacts
° Stack height	0								° no magnitude changes
Risk Weights									
° Direct and indirect chronic air									
(a) acute and chronic weights equal					0	0			
(b) acute air risks weight = 9 chronic air risks weight = 8					0	0			

Legend:

1. No change to ranking of siting options and negligible magnitude of difference changes.
2. Largely addressed by other sensitivity analyses.
3. Uncertainties re. results/prediction.
4. Additional data and analysis required to confirm conclusions.
5. Changes will not help to distinguish among LF-9C, LF-3C, LF-1E and LF-1E/PI-27E.
6. All options change in same direction by approximately the same amount. No change in ranking.
7. Degree of change in factor weight of factor suitability level cannot be supported.
8. Negligible changes in factor scores. No change in ranking.

TABLE 8.4

Screening of Sensitivity Analyses with No or Negligible Change

SENSITIVITY ANALYSES	REASONS FOR EXCLUSION								COMMENTS AND CONCLUSIONS
	1	2	3	4	5	6	7	8	
Risk Weights (cont'd)									
° Transportation (greater weight) (apply greater weight to transportation factor so that LF-4N/PI-1N preferred)							0		° transportation factors must become seven times more important than original weights
Impact Prediction									
° less conservative approach - noise impacts - access roads					0			0	
° Larger negative property value and out-migration impacts					0			0	
Impact Weights									
° Less weight - air impacts					0			0	
° Alternative positive and negative economic base factor weights					0			0	
Impacts - Mitigation and Compensation									
° Assume site vicinity noise impacts largely mitigable (design and operations changes)					0			0	

Legend:

1. No change to ranking of siting options and negligible magnitude of difference changes.
2. Largely addressed by other sensitivity analyses.
3. Uncertainties re. results/prediction.
4. Additional data and analysis required to confirm conclusions.
5. Changes will not help to distinguish among LF-9C, LF-3C, LF-1E and LF-1E/PI-27E.
6. All options change in same direction by approximately the same amount. No change in ranking.
7. Degree of change in factor weight of factor suitability level cannot be supported.
8. Negligible changes in factor scores. No change in ranking.

TABLE 8.4

Screening of Sensitivity Analyses with No or Negligible Change

SENSITIVITY ANALYSES	REASONS FOR EXCLUSION								COMMENTS AND CONCLUSIONS
	1	2	3	4	5	6	7	8	
Impacts - Mitigation and Compensation (cont'd)									
° Assume natural environmental site vicinity impacts mitigable (design and operations, habitat creation and enhancement)					0	0			
° Assume entire site assessed as industrial					0			0	
Future Conditions and Study Area Boundaries									
° Construction impacts	0				0				

Legend:

1. No change to ranking of siting options and negligible magnitude of difference changes.
2. Largely addressed by other sensitivity analyses.
3. Uncertainties re. results/prediction.
4. Additional data and analysis required to confirm conclusions.
5. Changes will not help to distinguish among LF-9C, LF-3C, LF-1E and LF-1E/PI-27E.
6. All options change in same direction by approximately the same amount. No change in ranking.
7. Degree of change in factor weight of factor suitability level cannot be supported.
8. Negligible changes in factor scores. No change in ranking.

8.3.4 REVIEW CASE FOR AND AGAINST INCLUSION OF SENSITIVITY ANALYSES

Table 8.5 lists the sensitivity analyses not screened. In addition, Table I.7 in Appendix I provides the arguments for and against the inclusion of these sensitivity analyses.

8.3.5 REVIEW IMPLICATIONS OF SENSITIVITY ANALYSES

In this section, the major implications of the sensitivity analyses for the ranking of siting options are highlighted. After highlighting the implications of the sensitivity analyses for the Milton siting options, a distinction is drawn between qualitative and quantitative sensitivity analyses. For the quantitative sensitivity analyses, further distinctions are drawn between risk and impact sensitivity analysis and between the aggregation by discipline and aggregation by study area procedures.

a) Milton Siting Options

The two Milton siting options are highly insensitive to changes in assumptions and interpretations. Both the qualitative and the quantitative sensitivity analyses reinforce the conclusion that the Milton siting options are less desirable than either the West Lincoln or the Niagara Falls siting options.

The only sensitivity analysis which places a Milton siting option among the top three ranked siting options involved a sevenfold increase in the weight attached to the transportation risk factors. This is clearly an unrealistically high value. Neither the factor ranking analysis nor the analysis of site-specific risks and impacts warrant such a change.

TABLE 8.5

Sensitivity Analyses Not Screened

Facility Characteristics

- haul methods for additives and reagents (road vs. road and rail)
- landfill type (conventional vs. shallow entombment)

Risk Prediction

- indirect air risks
- chronic air risks
- susceptibility of site to flooding

Risk Weights

- local and regional and province-wide routes
- transportation (less weight)

Risk Mitigation

- susceptibility of site to flooding
- ground and surface water use
- acute air risks

Impact Prediction

- ability of community to cope with change

Impact Weights

- industrial designation (greater weight)
- industrial designation (deleted for PI-27E) (lower weight)
- greater weight - displacement of farmland and farms
- greater weight - natural environmental factors - site and site vicinity
- business, agriculture, tourism components of economic base
- reduced weights - community and regional and access road impacts

Impacts - Mitigation and Compensation

- assume municipal services and municipal financial impacts mitigable through compensation
- assume on-site impacts mitigable - businesses, residents, farms, natural features, land uses
- assume impacts on adjacent residents, community and recreation features and farms are mitigable through property buy-out programs
- assume property value impacts mitigable (property value protection program)

TABLE 8.5 (cont'd)

Sensitivity Analyses Not Screened

Future Conditions and Study Area Boundaries

- future scenarios
- secondary access routes - West Lincoln
- definition of local and regional roads - Niagara Falls
- transportation (receptors)

Risks, Impacts and Costs

- greater weight - risks

The study area sensitivity analyses - the attachment of greater importance to the flooding potential at LF-3C and the redefinition of the local and regional access roads improve the position of LF-4N/PI-1N from fifth to fourth. In both cases, the difference between LF-4N/PI-1N and the fifth ranked option are slight. With the exception of the sevenfold increase in the importance attached to the transportation risk factors, no sensitivity analyses alter the sixth place position of LF-4N/PI-13N.

b) Qualitative Sensitivity Analyses

The results of the qualitative sensitivity analyses are briefly highlighted below. Further details regarding the application of sensitivity analyses are provided in Tables I.8 to I.11 in Appendix I.

The qualitative sensitivity analyses do not alter siting option rankings. The only qualitative sensitivity analyses where an appreciable change might occur pertains to the choice of conventional versus shallow entombed landfill technology and to the use of a logarithmic weighting system to distinguish between direct and indirect risks.[1]

The West Lincoln siting options are favoured over the Niagara Falls siting options in their suitability for either a conventional or a shallow entombed landfill technology. The Niagara Falls siting options are only suitable for a conventional landfill technology.

The use of a logarithmic weighting system for direct and indirect air risks also strongly favours the West Lincoln over the Niagara Falls siting options. The Niagara Falls siting option LF-1E/PI-27E is least favoured, from an air risk perspective, with this sensitivity analysis.

Four other qualitative sensitivity analyses tend to shift the overall preference slightly towards the Niagara Falls siting options. These sensitivity analyses include future scenarios, haul methods, i.e. rail for the haulage of additives and reagents*, secondary access routes (West Lincoln) and the ability of communities to cope with change.

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[1] The Ontario Research Foundation undertook an alternative weighting of risk indicators. With this procedure, a logarithmic scale was used to reflect more precisely the differences between various direct and indirect air quality factors as identified in the generic risk assessment (Environ, 1985).

c) Quantitative Sensitivity Analyses

Tables I.12, I.13 and I.14 in Appendix I list the factor scores for each quantitative sensitivity analysis. The following text briefly highlights the results of the quantitative sensitivity analyses for aggregation by discipline and by study areas. The same direction of change results from both procedures for all sensitivity analyses. However, the resultant siting option ranking varies between the two aggregation procedures.

i) Risks

The results of the risk quantitative sensitivity analyses for the West Lincoln and Niagara Falls siting options are highlighted in Table 8.6. The implications of the risk sensitivity analyses for siting option ranking for the two quantitative aggregation procedures are highlighted below:

Aggregation By Discipline Procedure - Risks

For the aggregation by discipline quantitative procedure, the preferred position of LF-9C is unchanged by any of the risk sensitivity analyses.

LF-1E/PI-27E also generally maintains its fourth place ranking, with one exception. The attachment of greater significance to flooding at LF-3C results in LF-1E/PI-27E being ranked more highly than LF-3C. A number of risk sensitivity analyses alter the rankings of LF-3C and LF-1E. These changes reflect the limited differences between the two options. The base case ranking favours LF-1E slightly over LF-3C. The risk sensitivity analyses which appreciably widens this gap is:

TABLE 8.6

Results of Quantitative Sensitivity Analyses - Risks

LF-9C MORE FAVOURED

Risks

Ranking Change

- indirect air risks (delete factors) (SA)[1]
- chronic air risks (delete factors) (SA)
- decrease local and regional access road weight (SA)
- delete water use and flooding factors (SA)

LF-9C LESS FAVOURED

LF-3C MORE FAVOURED

Risks

Ranking Change

- indirect air risks (delete factors) (D[2], SA)
- chronic air risks (delete factors) (D)
- increase weight for province-wide access roads (D)
- decrease weight for local and regional access roads (D)

LF-3C LESS FAVOURED

- susceptibility of site to flooding (adjust FSLs and weights) (D, SA)

---

[1] SA = Ranking change for aggregation by study area
[2] D = Ranking change for aggregation by discipline

TABLE 8.6 - Continued

Results of Quantitative Sensitivity Analyses - Risks

LF-3C MORE FAVOURED	LF-3C LESS FAVOURED
Risks	
Ranking Change	
o ground and surface water use and flooding factors (delete) (D)[1]	

LF-1E MORE FAVOURED	LF-1E LESS FAVOURED
Risks	
Ranking Change	
	o indirect air risks (delete factors) (D)
	o chronic air risks (delete factors) (D)
	o province-wide access route factor weight increased (D)
	o local and regional access road weight decreased (D)
	o water use and flooding factors deleted (D, SA[2])

---

[1] D = Ranking change for aggregation by discipline

[2] SA = Ranking change for aggregation by study area

TABLE 8.6 - Continued

Results of Quantitative Sensitivity Analyses - Risks

LF-1E/PI-27E MORE FAVOURED	LF-1E/PI-27E LESS FAVOURED
Risks	
Ranking Change	
o susceptibility of site to flooding (adjust FSLs and weights) (D)[1]	o indirect air risk (delete factors) (SA)[2]
	o chronic air risk (delete factors (SA)
	o decrease weight for local and regional access roads (SA)
	o delete water use and flooding factors (SA)

---

[1] D = Ranking change for aggregation by discipline
[2] SA = Ranking change for aggregation by study area

- attaching greater importance to the flooding risk at LF-3C.

Risk sensitivity analyses which reverse the preference for LF-1E include the following:

- deleting indirect air risks;
- deleting chronic air risks;
- attaching greater importance to province-wide access routes;
- attaching less importance to local and regional access routes;
- deleting water use and flooding factors;
- deleting transportation receptors on local and regional access routes.

Of the above, the only sensitivity analysis where a considerable gap emerges between the options is the deletion of the water use and flooding factors.

Aggregation By Study Area Procedure - Risks

For the aggregation by study area procedure, the only risk sensitivity analysis which alters the preferred position of LF-1E is the deletion of the ground and surface water use factors. In this case, the position of LF-1E drops from first to second, behind LF-9C.

With the aggregation by study area procedure, LF-3C is ranked fourth overall. The only risk sensitivity analysis which improves the relative position of LF-3C (from fourth to third) is the deletion of indirect air risks. Increasing the importance of flooding at LF-3C decreases the rank for this option.

A number of the risk sensitivity analyses alter the rankings of LF-9C and LF-1E/PI-27E. These changes reflect the limited differences between the two options. The base case favours LF-1E/PI-27E slightly over LF-9C. Sensitivity analyses which reverse the preference for LF-1E/PI-27E include the following:

- deleting indirect air risks;
- deleting chronic air risks;
- decreasing the weight of local and regional access routes;
- deleting water use and flooding factors.

Of the above, the only sensitivity analyses where a considerable gap emerges between the options is the deletion of indirect air risks and the deletion of water use and flooding factors.

ii) Impacts

The results of the impact sensitivity analyses for the West Lincoln and Niagara Falls siting options are highlighted in Table 8.7. The implications of the impact sensitivity analyses for siting option ranking for the two quantitative aggregation procedures are given below:

Aggregation by Discipline Procedure - Impacts and Study Areas

For the aggregation by discipline aggregation procedure, the preferred position of LF-9C is unchanged by any of the impact sensitivity analyses.

LF-1E/PI-27E also generally maintains its fourth place ranking, with two exceptions. The deletion of municipal finance impacts improves the position of LF-1E/PI-27E from fourth to third. Assuming that property value impacts are mitigable improves the position of LF-1E/PI-27E from fourth to second.

A number of impact sensitivity analyses alter the rankings of LF-3C and LF-1E. These changes reflect the limited differences between the two options. The base case ranking favours LF-1E slightly over LF-3C.

Sensitivity analyses which reverse this ranking include:

TABLE 8.7

Results of Quantitative Sensitivity Analyses - Impacts

LF-9C MORE FAVOURED	**LF-9C LESS FAVOURED**
Impacts and Boundary Changes	
Ranking Change	
o delete industrial designation for LF-1E/PI-27E (SA)[1]	
o increase weight for natural environment (SA)	
o redefine local and regional access road for West Lincoln, Niagara Falls (SA)	

LF-3C MORE FAVOURED	**LF-3C LESS FAVOURED**
Impacts and Boundary Changes	
Ranking Change	
o tourism economic component equals - economic base component (D)[2]	o delete municipal finance factor (D)

---

[1] SA = Ranking change for aggregation by study area

[2] D = Ranking change for aggregation by discipline

TABLE 8.7 - Continued

Results of Quantitative Sensitivity Analysis - Impacts

LF-3C MORE FAVOURED	**LF-3C LESS FAVOURED**
Impacts and Boundary Changes	
o all economic base components equal (D)[1] o reduce weights for community and regional and access roads (D) o definition of local and regional access roads (D) o transportation - indirect risk (delete receptors data for local and regional roads) (D)	o assume property value impacts are mitigable (D)
LF-1E MORE FAVOURED	**LF-1E LESS FAVOURED**
Impacts and Boundary Changes	
Ranking Change	
	o tourism economic component equals economic base (D) o all economic components equal (D) o assume on-site impacts mitigable (SA)[2] o assume property value impacts mitigable (D)

---

[1] D = Ranking change for aggregation by discipline
[2] SA = Ranking change for aggregation by study area

TABLE 8.7 - Continued

Results of Quantitative Sensitivity Analysis - Impacts

LF-1E MORE FAVOURED	LF-1E LESS FAVOURED
Impacts and Boundary Changes	
Ranking Change	o redefine local and regional access routes (D[1], SA[2])
	o reduce weights for community and regional and access roads (D)
	o delete transportation receptors (D)

LF-1E/PI-27E MORE FAVOURED	LF-1E/PI-27E LESS FAVOURED
Impacts	
Ranking Change	
o more emphasis on industrial designation for PI-27E (SA)	o delete industrial designation PI-27E (SA)
o delete municipal finance impacts (D)	o increase weight for natural environment factors (SA)
o assume on-site impacts are mitigable (SA)	
o assume property value impacts are mitigable (D)	

---

[1] D = Ranking change for aggregation by discipline

[2] SA = Ranking Change for aggregation by study area

- reduce weights for community and region and access roads,
- attaching greater importance to the tourism component of the economy;
- redefining local and regional access routes;
- assume all economic components have equal weight.

Aggregation By Study Area Procedure - Impacts

For the aggregation by study area quantitative aggregation procedure, three sensitivity analyses alter the overall preference for LF-1E. Attaching greater importance to the industrial designation of PI-27E and assuming on-site impacts are mitigable result in LF-1E/PI-27E being preferred to LF-1E. The redefinition of the local and regional access routes results in LF-9C being preferred overall.

Under the aggregation by study area procedure, LF-3C is ranked fourth overall. The only impact sensitivity analysis which improved the position of LF-3C (from fourth to third) is the redefinition of the local and regional access routes.

A number of impact sensitivity analyses alter the rankings of LF-9C and LF-1E/PI-27E. These changes reflect the limited differences between the two options. The base case favours LF-1E/PI-27E over LF-9C.

8.4 CONCLUSIONS

The following general conclusions result from the preceding analysis:

- The two Milton siting options are highly insensitive to changes in assumptions and interpretations. Both the qualitative and the quantitative analyses reinforce the conclusion that the Milton siting options are clearly less desirable than either the West Lincoln or the Niagara Falls siting options.

- The qualitative sensitivity analyses do not alter siting option rankings. The West Lincoln siting options are favoured over the Niagara Falls siting options in their suitability for either a conventional or a shallow entombed landfill technology and when greater importance is attached to direct air risks. The future scenarios, haul methods, secondary access routes and ability of community to cope with change slightly shift the overall preference towards the Niagara Falls siting options.

- The same direction of change, with respect to the ranking of siting options, results from both quantitative aggregation procedures. However, the resultant siting option rankings are not always the same for the two aggregation procedures.

- The quantitative risk sensitivity analyses generally favour the West Lincoln siting options. The preferred position of LF-9C for the aggregation of disciplines procedure is unchanged by the risk sensitivity analyses. LF-9C is ranked first before the sensitivity analyses are applied. The ranking of LF-9C changes for sensitivity analyses for aggregation by study area (from third to second and first). Similarly, with one exception (the deletion of the ground and surface water factors) the preferred first ranking of LF-1E for the study area aggregation procedure is unchanged by the risk sensitivity analyses. For the aggregation by discipline procedure, LF-1E is reduced in ranking from second to third in several cases.

- The limited differences between LF-3C and LF-1E with the disciplinary procedure and between LF-9C and LF-1E/PI-27E in the study area procedure are reflected in a range of values for risk sensitivity analyses which reverse the ranking of these options in favour of the West Lincoln options. The one exception is that the attachment of greater significance to flooding constraints reduces the position of LF-3C.

- The quantitative impact sensitivity analyses generally favour the West Lincoln and LF-1E/PI-27E siting options. The preferred position of LF-9C, for the aggregation by disciplines procedure, is unchanged by the impact sensitivity analyses. LF-9C is ranked first prior to the application of the sensitivity analyses. The ranking for LF-9C improves for several of the aggregation by study area sensitivity analyses. The first ranking of LF-1E over LF-9C, for the study area aggregation procedure, is reversed when the local and regional access roads are redefined. The preferred position of LF-1E over LF-1E/PI-27E for the study area aggregation procedure, is reversed when greater importance is attached to the industrial designation of PI-27E or if on-site impacts are assumed to be mitigable.

- The limited differences between LF-3C and LF-1E with the disciplinary procedure and between LF-9C and LF-1E/PI-27E with the study area procedure are again reflected in a range of impact sensitivity analyses which reverse the ranking of these options.

9.0 CONCLUSIONS AND RECOMMENDATIONS

9.1 INTRODUCTION

This chapter presents the overall Phase 4A conclusions and recommendations of the site selection coordinating consultant, M.M. Dillon Ltd.[1]

In this final chapter, the results of the four evaluation procedures are compared:

- a synthesis based upon a review of major differences and tradeoffs (Chapter 5);
- a disciplinary synthesis (Chapter 6);
- two quantitative aggregation procedures - a quantitative aggregation procedure by study area and risk pathway and a quantitative aggregation procedure by discipline and risk pathway (Chapter 7).

In addition, the implications of the sensitivity analyses, documented in Chapter 8, for the comparison are highlighted. The comparison provides the basis for the overall conclusions regarding the ranking of siting options. The chapter also consolidates the recommendations of the individual site selection consultants, together with the recommendations of the site selection coordinating consultant.

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[1] Conclusions, and the rationale for these conclusions, for each step in the Phase 4A site selection process are detailed on a chapter-by-chapter basis and are highlighted in the Executive Summary.

9.2 COMPARISON OF EVALUATION PROCEDURE RESULTS

9.2.1 MILTON SITING OPTIONS

The four evaluation procedures are consistent in their results regarding the two Milton siting options. LF-4N/PI-1N and LF-4N/PI-13N[1] are ranked fifth and sixth, respectively, by the disciplinary synthesis and by both quantitative aggregation procedures. The preferred Milton siting option, LF-4N/PI-1N is also less desirable than the preferred West Lincoln (LF-9C) and the preferred Niagara Falls siting option (LF-1E/PI-27E) in the differences and tradeoffs synthesis.

In addition, as described in Chapter 8 in Volume 1, LF-4N/PI-13N is basically unacceptable because of a failure to provide natural containment.

The rankings of the Milton siting options are highly insensitive to changes in assumptions and interpretations as illustrated in the sensitivity analyses detailed in Chapter 8 of Volume 2. Only with a sevenfold increase in the weight attached to transportation factors would a Milton siting option become preferred overall. Neither the analyses which provided the basis for the factor rankings (Chapter 4 of Volume 2), nor the site-specific analysis (Chapters 5 and 6 of Volume 2) provides the basis for such a change.

9.2.2 NIAGARA FALLS AND WEST LINCOLN SITING OPTIONS

Table 9.1 highlights the risk and impact differences among the four evaluation procedures for the Milton and West Lincoln siting options. Table 9.1 compares the results of the following evaluation procedures:

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[1] LF-4N/PI-13N was included in the detailed comparative evaluation as PI-13N was not determined to be basically unacceptable (see Chapter 8 in Volume 1) until the detailed comparative evaluation was largely completed.

- differences and tradeoffs (Chapter 5) vs. synthesis of disciplinary perspectives (Chapter 6);
- differences and tradeoffs (Chapter 5) vs. quantitative aggregation by study area/risk pathway (Chapter 7);
- synthesis of disciplinary perspectives (Chapter 6) vs. quantitative aggregation by discipline (Chapter 7);
- quantitative aggregation by study area/risk pathway vs. quantitative aggregation by discipline (Chapter 7).

The four most highly ranked siting options - LF-3C, LF-9C, LF-1E and LF-1E/PI-27E are all compared to each other for risk, impact and overall risk and impact rankings. In cases where no difference is noted in the table, the results of both procedures in the comparison favour the siting option noted. For example, in the comparison of the differences and tradeoffs vs.the synthesis of disciplinary perspectives procedures, LF-9C is ranked higher than LF-3C, and thus favoured over LF-3C, for both procedures for risks and impacts. Therefore, there is no difference between the results of the two procedures for the comparison between LF-3C and LF-9C. However, when the differences and tradeoffs and quantitative aggregation by study area/risk pathway procedures are compared for risks for LF-3C vs. LF-9C, the results of the quantitative aggregation by study areas/risk pathway favour LF-3C while the results of the differences and tradeoffs procedure favour LF-9C.

As previously noted, the engineering consultant, Monenco Ltd., concluded that, "the siting options (LF-3C and LF-9C) can be considered equal in terms of cost, due to the small variation in the capital and operating cost estimates and the results of the economic analysis"

TABLE 9.1

Comparison of Results of Evaluation Procedures

SITING OPTION	COMPARISON	DIFFERENCES AND TRADEOFFS VS. SYNTHESIS OF DISCIPLINARY PERSPECTIVES	DIFFERENCES AND TRADEOFFS VS. QUANTITATIVE AGGREGATION - STUDY AREA/ RISK PATHWAY	SYNTHESIS OF DISCIPLINARY PERSPECTIVES VS. QUANTITATIVE AGGREGATION - DISCIPLINE	QUANTITATIVE AGGREGATION - STUDY AREA/RISK PATHWAY VS. QUANTITATIVE AGGREGATION - DISCIPLINE
LF-3C	vs. LF-9C	° risks - no difference; LF-9C favoured ° impacts - no difference; LF-9C favoured ° overall - N/A	° risks - difference; LF-3C favoured - quantitative; LF-9C favoured - differences and tradeoffs* ° impacts - no difference; LF-9C favoured ° overall - no difference; LF-9C favoured	° risks - N/A ° impacts - no difference; LF-9C favoured ° overall - no difference; LF-9C favoured	° risks - LF-3C favoured ° impacts - no difference; LF-9C favoured ° overall - no difference; LF-9C favoured
	vs. LF-1E	N/A[1]	N/A	° risks - N/A ° impacts - no difference; LF-1E favoured ° overall - no difference; LF-1E favoured	° risks - LF-3C favoured ° impacts - no difference; LF-1E favoured ° overall - no difference; LF-1E favoured
	vs. LF-1E/ PI-27E	N/A	N/A	° risks - N/A ° impacts - no difference; LF-1E/PI-27E favoured ° overall - difference; LF-1E/PI-27E favoured - disciplinary; LF-3C favoured-quantitative*	° risks - LF-3C favoured ° impacts - no difference; LF-1E/PI-27E favoured ° overall - difference; LF-1E/PI-27E favoured - risk pathway/study area; LF-3C favoured - discipline*

*Indicates area of difference

[1] NA - not applicable; no comparison between the two evaluation procedures can be undertaken since at least one of the procedures does not produce an overall ranking of siting options for comparative purposes.

TABLE 9.1

Comparison of Results of Evaluation Procedures

SITING OPTION	COMPARISON	DIFFERENCES AND TRADEOFFS VS. SYNTHESIS OF DISCIPLINARY PERSPECTIVES	DIFFERENCES AND TRADEOFFS VS. QUANTITATIVE AGGREGATION - STUDY AREA/ RISK PATHWAY	SYNTHESIS OF DISCIPLINARY PERSPECTIVES VS. QUANTITATIVE AGGREGATION - DISCIPLINE	QUANTITATIVE AGGREGATION - STUDY AREA/RISK PATHWAY VS. QUANTITATIVE AGGREGATION - DISCIPLINE
LF-9C	vs. LF-3C	° risks - no difference; LF-9C favoured ° impacts - no difference; LF-9C favoured ° overall - N/A	° risks - difference; LF-3C favoured - quantitative; LF-9C favoured - differences and tradeoffs* ° impacts - no difference; LF-9C favoured ° overall - no difference; LF-9C favoured	° risks - N/A ° impacts - no difference; LF-9C favoured ° overall - no difference; LF-9C favoured	° risks - LF-3C favoured ° impacts - no difference; LF-9C favoured ° overall - no difference; LF-9C favoured
	vs. LF-1E	° risks - no difference; LF-9C favoured ° impacts - no difference; LF-1E favoured ° overall - N/A	° risks - no difference; LF-9C favoured ° impacts - no difference; LF-1E favoured ° overall - no difference; preference subject to interpretation	° risks - N/A ° impacts - difference; LF-9C favoured - quantitative; LF-1E favoured - disciplinary* ° overall - no difference; preference subject to interpretation	° risks - LF-9C favoured ° impacts - difference; LF-9C favoured - discipline; LF-1E favoured - study area* ° overall - difference - LF-1E favoured - study area; LF-9C favoured - discipline*

TABLE 9.1

Comparison of Results of Evaluation Procedures

SITING OPTION	COMPARISON	DIFFERENCES AND TRADEOFFS VS. SYNTHESIS OF DISCIPLINARY PERSPECTIVES	DIFFERENCES AND TRADEOFFS VS. QUANTITATIVE AGGREGATION - STUDY AREA/ RISK PATHWAY	SYNTHESIS OF DISCIPLINARY PERSPECTIVES VS. QUANTITATIVE AGGREGATION - DISCIPLINE	QUANTITATIVE AGGREGATION - STUDY AREA/RISK PATHWAY VS. QUANTITATIVE AGGREGATION - DISCIPLINE
LF-9C (cont'd)	vs. LF-1E/ PI-27E	° risks - no difference; LF-9C favoured ° impacts - no difference; LF-1E/PI-27E favoured ° overall - N/A	° risks - no difference; LF-9C favoured ° impacts - no difference; LF-1E/PI-27E favoured ° overall - no difference; preference subject to interpretation	° risks - N/A ° impacts - difference; LF-9C favoured - quantitative; LF-1E/PI-27E favoured - disciplinary* ° overall - difference; LF-9C favoured - quantitative*	° risks - LF-9C favoured ° impacts - difference; LF-9C favoured - discipline; LF-1E/PI-27E favoured - study area* ° overall - difference; LF-1E/PI-27E favoured - study areas; LF-9C favoured - discipline*
LF-1E	vs. LF-3C	N/A	N/A	° risks - N/A ° impacts - no difference; LF-1E favoured ° overall - no difference; LF-1E favoured	° risks - LF-3C favoured ° impacts - no difference; LF-1E favoured ° overall - no difference; LF-1E favoured
	vs. LF-9C	° risks - no difference; LF-9C favoured ° impacts - no difference; LF-1E favoured ° overall - N/A	° risks - no difference; LF-9C favoured ° impacts - no difference; LF-1E favoured ° overall - no difference; preference subject to interpretation	° risks - N/A ° impacts - difference; LF-9C favoured - quantitative; LF-1E favoured - disciplinary* ° overall - no difference; preference subject to interpretation	° risks - LF-9C favoured ° impacts - difference; LF-9C favoured - discipline; LF-1E favoured - study area* ° overall - difference; LF-1E favoured - study areas; LF-9C favoured - discipline*

* Indicates area of difference

TABLE 9.1

Comparison of Results of Evaluation Procedures

SITING OPTION	COMPARISON	DIFFERENCES AND TRADEOFFS VS. SYNTHESIS OF DISCIPLINARY PERSPECTIVES	DIFFERENCES AND TRADEOFFS VS. QUANTITATIVE AGGREGATION - STUDY AREA/ RISK PATHWAY	SYNTHESIS OF DISCIPLINARY PERSPECTIVES VS. QUANTITATIVE AGGREGATION - DISCIPLINE	QUANTITATIVE AGGREGATION - STUDY AREA/RISK PATHWAY VS. QUANTITATIVE AGGREGATION - DISCIPLINE
LF-1E (cont'd)	vs. LF-1E/ PI-27E	° risks - no difference; LF-1E favoured ° impacts - no difference; LF-1E/PI-27E favoured ° overall - N/A	° risks - no difference; LF-9C favoured ° impacts - difference; LF-1E/PI-27E favoured - differences and tradeoffs; LF-1E favoured - quantitative* ° overall - difference; LF-1E favoured - quantitative; LF-1E/PI-27E favoured - differences and tradeoffs*	° risks - N/A ° impacts - difference; LF-1E favoured - quantitative; LF-1E/PI-27E favoured - disciplinary* ° overall - difference; LF-1E favoured quantitative; disciplinary preference subject to interpretation*	° risks - LF-1E and LF-1E/PI-27E equal ° impacts - no difference; LF-1E favoured ° overall - no difference; LF-1E favoured
LF-1E/ PI-27E	vs. LF-3C	N/A	N/A	° risks - N/A ° impacts - no difference; LF-1E/PI-27E favoured ° overall - difference; LF-1E/PI-27E favoured - disciplinary; LF-3C favoured - quantitative*	° risks - LF-3C favoured ° impacts - no difference; LF-3C favoured ° overall - difference; LF-1E/PI-27E favoured - risk pathway/study area; LF-3C favoured - discipline*

* Indicates area of difference

TABLE 9.1

Comparison of Results of Evaluation Procedures

SITING OPTION	COMPARISON	DIFFERENCES AND TRADEOFFS VS. SYNTHESIS OF DISCIPLINARY PERSPECTIVES	DIFFERENCES AND TRADEOFFS VS. QUANTITATIVE AGGREGATION - STUDY AREA/ RISK PATHWAY	SYNTHESIS OF DISCIPLINARY PERSPECTIVES VS. QUANTITATIVE AGGREGATION - DISCIPLINE	QUANTITATIVE AGGREGATION - STUDY AREA/RISK PATHWAY VS. QUANTITATIVE AGGREGATION - DISCIPLINE
LF-1E/ PI-27E (cont'd)	vs. LF-9C	° risks - no difference; LF-9C favoured ° impacts - no difference; LF-1E/PI-27E favoured ° overall - N/A	° risks - no difference; LF-9C favoured ° impacts - no difference; LF-1E/PI-27E favoured ° overall - no difference; preference subject to interpretation	° risks - N/A ° impacts - difference; LF-9C favoured - quantitative; LF-1E/PI-27E favoured - disciplinary* ° overall - difference; LF-9C favoured - quantitative; disciplinary preference subject to interpretation*	° risks - LF-9C favoured ° impacts - difference; LF-9C favoured - discipline; LF-1E/PI-27E favoured - study area* ° overall - difference; LF-1E favoured - risk pathway/study area; LF-9C favoured - discipline
	vs. LF-1E	° risks - no difference; LF-1E favoured ° impacts - no difference; LF-1E favoured ° overall - N/A	° risks - difference; no difference between LF-1E and LF-1E/PI-27E - quantitative; LF-1E favoured - differences and tradeoffs* ° impacts - no difference; LF-1E favoured ° overall - no difference; preference subject to interpretation	° risks - N/A ° impacts - no difference; LF-1E favoured ° overall - no difference; LF-1E favoured	° risks - LF-1E and LF-1E/PI-27E equal ° impacts - no difference; LF-1E favoured ° overall - difference; LF-1E favoured quantitative discipline*

* Indicates area of difference

(Monenco, 1986, p.xv). The implications of the various sensitivity analyses are addressed in the text which follows.

a) Differences and Tradeoffs vs. Quantitative Aggregation Study Area/Risk Pathways

Two major differences are evident in the comparison of the results of the differences and tradeoffs synthesis and the quantitative (study area) procedures. In the LF-3C versus LF-9C comparison, LF-9C is favoured in the differences and tradeoffs synthesis for risk and for risks and impacts combined. LF-3C is favoured in the quantitative (study area) aggregation procedure for risk with an overall preference for LF-9C. In the LF-1E versus LF-1E/PI-27E comparison (both impacts and overall), LF-1E/PI-27E is preferred in the differences and tradeoffs synthesis. LF-1E is favoured in the quantitative (study area) procedure.

The limited risk differences between LF-3C and LF-9C are illustrated in the overlap which occurs when a 5% error estimate is applied to the quantitative aggregation results. It is also illustrated in the marginal preference for LF-9C over LF-3C in the differences and tradeoffs synthesis.

In the differences and tradeoffs synthesis, both LF-3C and LF-9C are highly rated from an overall air risk perspective, although LF-3C is slightly favoured. The minor air risk differences between the options are considered of limited significance. Similarly, both sites offer good natural containment, as reflected in long estimated breakthrough times. The greater ground water use constraint associated with LF-9C is diminished in importance by the site's good natural containment.

In contrast, neither site is highly ranked for transportation risk. LF-3C is the least favoured site for flood susceptibility. Thus, the selection of LF-9C over LF-3C would offer an opportunity to offset potential transportation and surface water risks. The desirability of reducing air and hydrogeologic risks is less of a concern in this case because of the good natural containment and the favourable overall air risk ratings possessed by both sites.

The implications of attaching greater importance to minimizing the potential flooding risk at LF-3C is illustrated in a sensitivity analysis which adjusted suitability levels and factor weights to reflect this concern. When this sensitivity analysis is applied to the risk ranking of siting options, LF-9C is favoured over LF-3C.

The limited differences between LF-1E and LF-1E/PI-27E is illustrated in the overlap which occurs when a 5% error estimate is applied to the quantitative aggregation results. It is also illustrated in the conclusion, cited in the differences and tradeoffs synthesis, that the overall differences between the two options are limited.

The basis for the difference between the results of the two procedures stems from the importance attached to the industrial designation of PI-27E. In the differences and tradeoffs analysis, particular importance is attached to the industrial designation of PI-27E because:

- the OWMC facility, particularly the incinerator and the physical/chemical treatment plant, share many of the characteristics of medium to heavy industries;

- with an industrial designation, there are already changes, e.g. land value and land ownership changes, which may preclude continued agricultural use beyond the short-term;

- with an industrial designation, uses and features on-site will likely be displaced at some point in the future;

- the placement of the facilities on an industrially-designated site appears consistent with local and regional planning policies;
- development within an industrial designation is likely to be more compatible with surrounding land uses; there is the expectation of industrial-type development by residents and uses in the vicinity of such designations;
- the extension of services to the facility could contribute to further industrial-type development; such a pattern is more consistent with policies which already favour industrial development in an area.

In comparing the two options, the differences and tradeoffs synthesis also points to the closer proximity of compatible industrial uses and designations to PI-27E.

The implications of attaching greater importance to the industrial designation of PI-27E is illustrated in a sensitivity analysis which treated on-site social and biological impacts as equal for the Niagara Falls siting options, and increased the weights for planned and proposed land use. When this sensitivity analysis is applied, it results in an overall preference for LF-1E/PI-27E over LF-1E. A similar reversal of rankings occurred where the on-site impacts are assumed mitigable.

b) Disciplinary Synthesis vs. Quantitative Aggregation - Discipline

Two important differences are evident in the comparison of the results of the disciplinary aggregation procedures and the disciplinary synthesis. They pertain to the LF-1E versus LF-1E/PI-27E comparison and to the LF-3C versus LF-1E/PI-27E comparison.

As in the previous comparison, LF-1E is ranked higher than LF-1E/PI-27E in the quantitative aggregation procedure. The reverse is the case with the qualitative disciplinary synthesis. In both cases, the differences are indicated as limited, as reflected in the overlap which occurs when a 5% error estimate is applied to the quantitative aggregation results. It is also illustrated in the recognition of the difficult tradeoffs between the two options in the disciplinary synthesis.

As in the differences and tradeoffs synthesis, the overall preference for LF-1E/PI-27E relies quite heavily on the particular importance attached to the industrial designation of PI-27E. The application of the sensitivity analysis, which attached greater importance to the industrial designation of PI-27E, narrows the gap between the two options. The rankings are not, however, reversed. Other related sensitivity analyses which narrow the gap between the two options (and which collectively would reverse the rankings) include assuming that on-site and adjacent impacts are fully mitigable, and the attachment of greater weight to the agricultural component of the economy. The rankings of the options are also reversed when property value impacts are assumed mitigable.

LF-3C is ranked more highly overall than LF-1E/PI-27E in the aggregation by risk pathway and discipline. The reverse is the case in the disciplinary synthesis. The limited differences between the two options is illustrated in the overlap which occurs when a 5% error estimate is applied to the quantitative aggregation results. It is also reflected in the fact that the two options are ranked at the same risk level in the disciplinary synthesis.

In the disciplinary synthesis, the major surface water differences and moderate transportation differences favouring LF-1E/PI-27E, and the major hydrogeologic and moderate air differences favouring LF-3C roughly balances out. In the quantitative aggregation, the lower ranking for flood susceptibility contributes to an overall risk preference for LF-3C. When greater weight is attached to the susceptibility of flooding concern at LF-3C, the gap narrows with one score and the positions are reversed with another score.

The gap between the two options also narrows (and possibly reverses, depending on the combination of sensitivity analysis employed) when greater importance is attached to the industrial designation of PI-27E, when greater weight is attached to the agricultural component of the economy, and when on-site and adjacent impacts are assumed mitigable. The positions of the two options are also reversed when the municipal finance factors are deleted and when property value impacts are assumed to be mitigable. In the disciplinary synthesis, limited importance is attached to municipal finance differences among the West Lincoln and Niagara Falls options because they were positive in all cases.

In the disciplinary aggregation, LF-9C is ranked higher than either LF-1E or LF-1E/PI-27E. In the disciplinary synthesis, the choice among these three options hinges on some difficult tradeoffs and interpretations. A case can be made for any of the three options. The limited differences between LF-9C and LF-1E are reflected in the overlap which occurs between the two options when the 5% error estimate is applied. No overlap occurs when the 5% error is applied to LF-1E/PI-27E.

The gap between the rankings of LF-9C and LF-1E/PI-27E are considerably diminished when:

- the industrial designation for PI-27E is given greater weight;
- municipal financial impacts are deleted;
- on-site impacts are assumed mitigable;
- property value impacts are assumed mitigable.

As described in the subsequent section, the final choice among these options depends on the interpretation of a small number of key tradeoffs.

c) Quantitative Aggregation - Disciplinary vs. Quantitative Aggregation - Study Area

The two quantitative aggregation procedures produce different rankings for the top four siting options, as indicated below:

Ranking	Aggregation by Risk Pathway and Study Area	Aggregation by Risk Pathway and Discipline
1	LF-1E	LF-9C
2	LF-1E/PI-27E	LF-1E
3	LF-9C	LF-3C
4	LF-3C	LF-1E/PI-27E

The fact that the two aggregation procedures produce two different siting option rankings is a further reflection of the limited differences among the four most highly ranked siting options. Other indications of these limited differences across the options (and the conflicting interpretations which can be placed on those differences) include:

- with the aggregation by study area, using a 1% error estimate, LF-1E/PI-27E and LF-9C overlap; using a 5% error estimate, LF-1E, LF-1E/PI-27E and LF-9C overlap;

- with the aggregation by discipline, using a 1% error estimate, LF-1E and LF-3C overlap; using a 5% error estimate, LF-9C, LF-1E and LF-3C overlap;

- as detailed in Chapter 8, several sensitivity analyses, when applied to the disciplinary aggregation, result in ranking reversals, particularly between LF-3C and LF-1E;

- as detailed in Chapter 8, several sensitivity analyses, when applied to the study area aggregation, result in ranking reversals, particularly between LF-9C and LF-1E/PI-27E.

As indicated in the following conclusions, the choice among the four most highly ranked options, and especially among LF-1E, LF-1E/PI-27E and LF-9C, depends upon interpretations of a small number of difficult tradeoffs.

9.3 CONCLUSIONS

The following conclusions pertain to the comparative evaluation of the six siting options - LF-4N/PI-1N and LF-4N/PI-13N in Milton, LF-3C and LF-9C in West Lincoln, and LF-1E and LF-1E/PI-27E in Niagara Falls. The conclusions and the rationale for those conclusions for each step in the Phase 4A site selection process are detailed on an individual chapter basis and are highlighted in the Executive Summary.

9.3.1 MILTON SITING OPTIONS

The Milton siting options are clearly less suitable than the other four siting options. This pattern is maintained across all three evaluation procedures. It is also reflected in the limited sensitivity of the ranking of the two options to changes in assumptions and interpretations.

Of the two Milton siting options, LF-4N/PI-13N is less suitable. Moreover, as discussed in Chapter 8 in Volume 1, as LF-4N/PI-13N fails to ensure natural containment it is basically unacceptable.

9.3.2 LF-3C IN WEST LINCOLN

Of the four remaining options, LF-3C is the least preferred. The major reasons for this conclusion include the following:

- LF-3C is the least desirable siting option from a transportation and flood susceptibility risk perspective. LF-9C shares LF-3C's natural containment and air risk advantages. However, LF-9C fails to share, to the same extent, LF-3C's transportation (longest local and regional access road system) and surface water risk (greatest flooding potential) disadvantages.

- LF-3C is ranked fourth overall for impacts in the disciplinary synthesis and in the quantitative aggregation by discipline. LF-3C is ranked sixth overall for impacts in the quantitative aggregation by study area procedure. LF-9C is preferred to LF-3C in the differences and tradeoffs synthesis.

- LF-3C is ranked fourth in the quantitative aggregation by study area procedure for site, site vicinity and community and regional impacts. It is ranked sixth in the quantitative aggregation procedure for access road impacts.

- LF-3C is ranked the least desirable siting option by the agriculture and social consultants. It is also ranked fourth overall by the land use, economic base and biology consultants. Of the impact consultants, LF-3C is only highly ranked by the municipal finance and air impact consultant. Municipal finance and air impacts involve moderately ranked factors. In both cases, these advantages are also possessed by LF-9C. However, LF-9C does not possess, to the same extent, the impact disadvantages associated with LF-3C.

9.3.3 LF-9C IN WEST LINCOLN AND LF-1E AND LF-1E/PI-27E IN NIAGARA FALLS

The choice among these three siting options, involves some difficult tradeoffs and interpretations. The limited difference across these options is reflected in the different results which emerge, depending on the aggregation procedure employed. It is also evident in the ranking variations which occur when different sensitivity analyses or combinations of sensitivity analyses are employed. The major advantages of each of these siting options are highlighted in Table 9.2. A much more detailed description of the advantages and limitations of these three siting options is presented in Chapters 5 and 6 of this volume. The final choice depends on the importance attached to the collective strengths and limitations associated with each of the three siting options.

9.4 RECOMMENDATIONS

The Ontario Waste Management Corporation has selected LF-9C (OWMC, 1985a) as its preferred siting option. Table 9.3 contains a detailed series of recommendations concerning suggested refinements and additional analyses, and possible mitigative and compensation measures. The recommendations are specific to site LF-9C. They represent a consolidation of the recommendations of the individual site selection consultants, together with those of the site selection coordinating consultant, M.M. Dillon Limited.

The suggested refinements and additional analyses are directed towards reducing potential areas of uncertainty, and in providing the data bases for risk and impact management and monitoring. In considering potential refinements and additional analyses, more detailed analyses, for their own sake, are not desirable. Such analyses should only be undertaken where they can be linked to such objectives as:

TABLE 9.2

Major Advantages - LF-1E, LF-1E/PI-27E and LF-9C[1]

LF-1E		LF-1E/PI-27E		LF-9C	
ADVANTAGES	EVALUATION METHODS	ADVANTAGES	EVALUATION METHODS	ADVANTAGES	EVALUATION METHODS
° potentially provides natural containment comparable to LF-9C	I.T. D.S.	° potentially provides comparable natural containment; flexibility to avoid constraints - two sites	I.T. D.S.	° preferred hydrogeology - maximizes natural containment potential	I.T. D.S. Q.A.
° preferred - surface water risk	I.T. D.S. Q.A.	° preferred - surface water risk	I.T. D.S. Q.A.	-	
° comparable (to LF-9C) - overall air risk	D.S. I.T.	-		° preferred - air risk; preference reinforced with greater weight to direct air pathways	I.T. D.S. Q.A. S.A.
° preferred - overall transportation risk and for local and regional access system	I.T. D.S. Q.A.	° preferred - overall transportation risk and for local and regional access system	I.T. D.S. Q.A.	° preferred - province-wide access system and for overall transportation risk when local and regional access roads redefined	I.T. D.S. S.A.
-		-		° preferred - overall risk; risks ranked more highly than impacts	I.T. D.S. Q.A.
° preferred to LF-9C - social, land use, and agriculture; preferred to LF-1E/PI-27E - social, economic, municipal finance, biology, air	D.S. Q.A.-D. I.T.	° preferred to LF-9C - agriculture, social and land use; preferred to LF-1E - agriculture and land use	D.S. Q.A.-D. I.T.	° preferred to LF-1E/PI-27E - economic, municipal finance, biology, air; preferred to LF-1E/PI-27E - social (Q.A.-D. only); preferred to LF-1E - economic, municipal finance, biology, air; LF-9C and LF-1E - no difference - biology (Q.A.-D. only)	D.S. I.T. Q.A.-D.

[1] I.T. - Issues and Tradeoffs Analysis
D.S. - Disciplinary Synthesis
S.A.-S.A. - Sensitivity Analysis - Study Areas
Q.A.-S.A. - Quantitative Aggregation - Risk Pathways and Study Areas
Q.A.-D. - Quantitative Aggregation - Risk Pathways and Disciplines
S.A.-D. - Sensitivity Analysis - Disciplinary

TABLE 9.2

Major Advantages - LF-1E, LF-1E/PI-27E and LF-9C[1]

LF-1E		LF-1E/PI-27E		LF-9C	
ADVANTAGES	EVALUATION METHODS	ADVANTAGES	EVALUATION METHODS	ADVANTAGES	EVALUATION METHODS
• preferred to LF-1E/PI-27E - impact disciplines	Q.A.-D.	• preferred - impact disciplines	D.S.	• preferred - impact disciplines	Q.A.-D.
• preferred to LF-9C - site vicinity, community and regional and access road impacts; preferred to LF-9C - site vicinity and access roads; preferred to LF-1E/PI-27E - site, site vicinity and access roads	I.T. Q.A.-S.A. Q.A.-S.A.	• preferred to LF-9C - site vicinity, community and regional and access road impacts; preferred to LF-1E - site and site vicinity	I.T. I.T.	• preferred to LF-1E - site; preferred to LF-1E - site and community and regional; preferred to LF-1E/PI-27E - site; preferred to LF-1E/PI-27E - site, site vicinity, community and regional	I.T. Q.A.-S.A. I.T. Q.A.-S.A.
• preferred - study areas	Q.A.-S.A.	• preferred - study areas; preferred to LF-9C	I.T. Q.A.-S.A.	-	
• preferred ranking over LF-1E/PI-27E - relatively insensitive to input changes	S.A.-S.A.	-		• preferred ranking; highly insensitive to input changes	S.A.-D.
-		• ranking after LF-1E reversed when: - greater weight attached to industrial designation - PI-27E - on-site impacts assumed mitigable	Q.A.-S.A.	• ranking after LF-1E reversed when: - greater weight attached to risks - ground and surface water use deleted - local and regional roads redefined	S.A.-S.A.
		• ranking after LF-1E reversed when: - property value impacts assumed mitigable	S.A.-D.	• ranking after LF-1E/PI-27E reversed when: - greater weight attached to risk - indirect air risks deleted - chronic air risks deleted	S.A.-S.A.

[1] I.T. - Issues and Tradeoffs Analysis
D.S. - Disciplinary Synthesis
S.A.-S.A. - Sensitivity Analysis - Study Areas
Q.A.-S.A. - Quantitative Aggregation - Risk Pathways and Study Areas
Q.A.-D. - Quantitative Aggregation - Risk Pathways and Disciplines
S.A.-D. - Sensitivity Analysis - Disciplinary

TABLE 9.2

Major Advantages - LF-1E, LF-1E/PI-27E and LF-9C[1]

LF-1E		LF-1E/PI-27E		LF-9C	
ADVANTAGES	EVALUATION METHODS	ADVANTAGES	EVALUATION METHODS	ADVANTAGES	EVALUATION METHODS
-		-		- weight reduced - local and regional access roads (to 8) - water use and flooding factors deleted - industrial designation - PI-27E deleted - greater weight - natural environmental factors - local and regional roads redefined	
				° preferred - engineering flexibility - can accommodate both conventional and shallow entombed technology	I.T. D.S.
° preferred overall	Q.A.-S.A.	° preferred overall to LF-1E	D.S. I.T.	° preferred overall	Q.A.-D.

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[1] I.T. - Issues and Tradeoffs Analysis
D.S. - Disciplinary Synthesis
S.A.-S.A. - Sensitivity Analysis - Study Areas
Q.A.-S.A. - Quantitative Aggregation - Risk Pathways and Study Areas
Q.A.-D. - Quantitative Aggregation - Risk Pathways and Disciplines
S.A.-D. - Sensitivity Analysis - Disciplinary

TABLE 9.3

Recommendations - Additional Analyses and Mitigative/Compensation Measures

SUGGESTED REFINEMENTS AND ADDITIONAL ANALYSES	POSSIBLE MITIGATIVE/COMPENSATION MEASURES - SUGGESTED FOR CONSIDERATION
GENERAL	
o refine risk assessment o undertake analysis of risks, impacts and costs associated with the extension of services, e.g. hydro, gas, water, storm and sanitary sewers, drainage works, from and to the facility o consider effects associated with decommissioning and after use o review the implications of refinements in waste quantities and sources, facility design and operations and the role of rail access o further review similar settings and facilities o refine future scenarios and analysis of construction impacts	o initiate baseline monitoring o formulate contingency programs and plans including risks and responsibilities o formulate facility characteristics, environmental, risk and impact monitoring programs o review measures to maximize worker safety o review impacts to date and possible means of ameliorating those impacts
RISKS	
Hydrogeology	
o undertake a detailed hydrogeologic assessment of the preferred site; would confirm the Phase 4A analysis; hydrogeologic design parameters would also be provided to the design engineer to ensure that the final site design and operations are compatible with the hydrogeologic setting	

TABLE 9.3

Recommendations - Additional Analyses and Mitigative/Compensation Measures

SUGGESTED REFINEMENTS AND ADDITIONAL ANALYSES	POSSIBLE MITIGATIVE/COMPENSATION MEASURES - SUGGESTED FOR CONSIDERATION
RISKS **Hydrogeology** - Cont'd	
o undertake a geotechnical assessment to assist in the conceptual foundation design; should be integrated with the hydrogeologic studies to optimize use of field and laboratory testing o refine predictions of contaminant emissions from the various facilities that could potentially migrate into the ground water environment o consider in greater detail ground water use in the vicinity of the site o review in greater detail leachate quality o consider in greater detail the potential for the lateral migration of contaminants in the fracture zone o refine hydrogeologic modelling and testing; particular reference to potential for incorporation into risk assessment	o review in greater detail the potential for reducing hydrogeologic risks through landfill design changes, e.g. shallow entombment o develop a detailed ground water monitoring program to serve as an early warning mechanism of design concept failures o formulate contingency designs and plans to act as a back up in the event that the monitoring system identifies potential problems o review potential for the provision of alternative ground water supplies o refine hydrogeologic assessment along local and regional access routes; could serve as a guide for mitigation of potential spills
Transportation	
o refine analysis of potentially affected area and receptors - transportation spill events o refine analysis of transportation access to site o refine transportation risk analysis as a component of the risk analysis	o explore the possible use of partial solidification to reduce transportation risks o investigate the control of truck transport movements on the identified local and regional access routes

TABLE 9.3

Recommendations - Additional Analyses
and Mitigative/Compensation Measures

SUGGESTED REFINEMENTS AND ADDITIONAL ANALYSES	POSSIBLE MITIGATIVE/COMPENSATION MEASURES - SUGGESTED FOR CONSIDERATION
RISKS	
Transportation - Cont'd	o review potential for construction/ operations improvements along local and regional roads which would further reduce transportation risks o review other possible procedures, e.g. driver training, vehicle design, control of haulage times which would further reduce transportation risks o review potential risks associated with special vehicles, e.g. school buses, agricultural vehicles and possible procedures for further reducing potential risks o refine transportation contingency analysis and planning o review need and potential for special measures for highly sensitive uses, e.g. schools along access routes
Air Dispersion/Air Quality	
o collect site-specific dispersion data; undertake further dispersion modelling using those data o refine analyses of evaporation emissions as part of consideration of partial solidification options o refine and validate Phase 4A air dispersion/air quality analyses	o develop long-term monitoring of air quality levels o refine analysis of air quality risks - short-term events

TABLE 9.3

Recommendations - Additional Analyses and Mitigative/Compensation Measures

SUGGESTED REFINEMENTS AND ADDITIONAL ANALYSES	POSSIBLE MITIGATIVE/COMPENSATION MEASURES - SUGGESTED FOR CONSIDERATION
RISKS	
Air Disperion/Air Quality - Cont'd o refine analysis of direct and indirect air pathways as part of the site-specific risk analysis o review potential impacts to natural environment from air emissions	
Surface Water o confirm estimates of flood susceptibility through detailed hydrologic and hydraulic analysis o undertake detailed surface drainage investigations on the site and in the site vicinity o consider surface water use in vicinity of site o consider potential for ground-surface water connections o consider refining surface water analysis to incorporate into site-specific risk assessment; the analysis of risk would consider - sources of pollution, modes of facility operations, potential pathways such as on-site spills and ground-surface water connections, dilution capabilities, flow characteristics and water quality of receiving streams and downstream water users	o refine surface water analysis in a form suitable for impact prediction and contingency planning o obtain background water quality and quantity data prior to facilities development to provide a basis for comparisons with future monitoring data o review potential for the provision of alternative surface water supplies o initiate a detailed surface water monitoring program to serve as an early warning mechanism o formulate contingency designs and plans to act as a back up in the event that the monitoring system identifies potential problems o refine surface water assessment along local and regional access routes; would serve as a guide for mitigation of potential spills

TABLE 9.3

Recommendations - Additional Analyses and Mitigative/Compensation Measures

SUGGESTED REFINEMENTS AND ADDITIONAL ANALYSES	POSSIBLE MITIGATIVE/COMPENSATION MEASURES - SUGGESTED FOR CONSIDERATION
IMPACTS Site o confirm archaeological resources o refine analysis of historical resources o refine analysis of potential on-site impacts on residents, businesses and farms o refine analysis of potential on-site biological impacts; recommended that year-round investigation of biological conditions be undertaken; particular reference to confirmation of rare plant and animal species	o determine archaeological mitigation required; undertake mitigation o determine need for historical resource mitigation; undertake mitigation measures to the extent that needed o formulate and institute program to compensate and relocate residents, businesses and farms o review potential for relocating buildings o formulate appropriate mitigative measures to minimize impacts on biological resources from construction, maintenance and operations of facilities; review potential for enhancing biological resources o analyse potential measures which could be instituted on site to minimize off-site impacts, e.g. berming, sequence of development, noise, dust and odour attenuation, placement and architectural treatment of buildings and facilities, landscaping, security, fencing

TABLE 9.3

Recommendations - Additional Analyses and Mitigative/Compensation Measures

SUGGESTED REFINEMENTS AND ADDITIONAL ANALYSES	POSSIBLE MITIGATIVE/COMPENSATION MEASURES - SUGGESTED FOR CONSIDERATION
IMPACTS	
Site Vicinity	
o refine analysis of potential nuisance effects, eg. noise, dust, odour, lighting o refine analysis of potential visual impacts o refine analysis of potential land value impacts o refine analysis of potential impacts on farm operations, businesses and community and recreation features o undertake additional data collection - residents, agricultural resources and surface water uses to the extent required for site-specific risk analysis o refine analysis of residential clusters and hamlets within and beyond Phase 4A site vicinity o refine analysis of perceived impacts and risks in site vicinity	o review potential for off-site mitigation of nuisance effects, e.g. sound proofing, berming o review potential for and alternative methods of voluntary purchase of most directly affected properties o review potential for and alternative methods of property value protection o work with municipalities and Province regarding land use planning in site vicinity o review potential measures to minimize, on a feature-by-feature basis, potential off-site impacts on residents, farms, businesses and community and recreation features o review need for and potential mitigative measures - impacts on residential clusters and hamlets o formulate and institute monitoring program - site vicinity impacts - human and natural environment o review potential measures off-site to attenuate visual impacts, e.g. tree plantings o determine need for and institute, if required, measures to minimize off-site biological impacts; review potential for enhancing biological resources in site vicinity o review and institute, as needed, measures to minimize perceived risks and impacts

TABLE 9.3

Recommendations - Additional Analyses and Mitigative/Compensation Measures

SUGGESTED REFINEMENTS AND ADDITIONAL ANALYSES	POSSIBLE MITIGATIVE/COMPENSATION MEASURES - SUGGESTED FOR CONSIDERATION
IMPACTS	
Access Roads	
o refine analysis of potential noise impacts along access roads o refine analysis of potential conflict with local traffic o refine analysis of potential conflict with access to and from uses along local and regional access roads o refine analysis of impacts from vehicles entering or leaving facility as a result of, for example, dust and clay on tires o refine analysis of alternative locations, and associated impacts, for disposal of excavated materials o refine access road impact analysis in conjunction with refinements to waste quantities and source analysis o refine analysis of existing and potential conflict with future uses of and along access routes o undertake additional data collection along access routes to the extent required for site-specific risk assessment o refine analysis of perceived impacts and risks along access routes	o review need for and potential methods of attenuating access road impacts - residents, farms, businesses, community and recreation features, biological resources o review methods of preventing or minimizing access road impacts through on-site design, operations, maintenance or policy measures o formulate and institute monitoring program - access road impacts - human and natural environment o review and institute, as needed, measures to minimize perceived risks and impacts

TABLE 9.3

Recommendations - Additional Analyses and Mitigative/Compensation Measures

SUGGESTED REFINEMENTS AND ADDITIONAL ANALYSES	POSSIBLE MITIGATIVE/COMPENSATION MEASURES - SUGGESTED FOR CONSIDERATION
IMPACTS **Community and Regional**	
o undertake a more detailed analysis of social community characteristics and potential impacts on community character, social cohesion and social stability o undertake a more detailed analysis of potential for and impacts from in-migration and out-migration o undertake a more detailed analysis of adaptability of community to change o refine analysis of municipal service and finance impacts o refine analysis of potential economic base impacts o refine analysis of potential impacts on agricultural community and economy o undertake additional data collection in community and regional study area to the extent required for site-specific risk assessment o refine analysis of perceived risks and impacts in community and regional study area; particular reference to potential effects on marketability of goods o review land use planning implications for community and regional study area o refine analysis of potential construction - related impacts in community and regional study area	o formulate baseline and long-term social, agricultural, economic and municipal service and finance monitoring program o investigate means of assisting community in adapting to facility related changes; investigate means of adapting facility to enhance potential for community adaptability and acceptance o review need for and potential methods of attenuating community and regional impacts o interview commodity organizations and food processing industry representatives to determine ways of mitigating potential resistance to purchase of local crops and/or livestock o review need for and alternative methods of mitigating in-migration and out-migration o review and institute, as needed, measures to minimize perceived risks and impacts o work with community to define role in emergency planning o refine analysis of extent of financial compensation to local and regional municipality o review potential roles of community in identifying, instituting and monitoring impacts and mitigative/compensation measures

- the confirmation of site acceptability;

- the resolution of areas of uncertainty pertinent to potential risks and impacts;

- the formulation and institution of mitigative and/or compensation measures;

- the provision of a data base for monitoring and/or contingency planning purposes;

- the provision of data necessary to respond to agency and public concerns and priorities.

The suggested mitigative/compensation measures represent a broad range of possible measures which might help prevent, reduce or offset potential risks and impacts. It may well be determined that some measures:

- are unnecessary;

- can be substituted for other measures;

- are undesirable, i.e. more adverse effects might result from the measure than from the risk or impact that they are directed towards;

- require action by or cooperation by agencies or parties other than OWMC.

Finally, OWMC's decisions regarding both additional analyses and mitigative/compensation measures will be the product of extensive internal deliberations, as well as extensive discussions with interested and affected agencies, groups and individuals.

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GLOSSARY OF TERMS

1. Acceptable Daily Intake (ADI): Estimate of the largest amount of chemical to which a person can be exposed on a daily basis which is anticipated to result in no adverse effects (usually expressed in mg/kg/day).

2. access roads: Access roads refers to the roads that will be travelled by vehicles carrying special wastes, additives and reagents and intersite transfer materials (treated wastes) to and from the OWMC facilities. Preferred access roads have been chosen by the site selection team for routes from the 400 series highway to the candidate sites. The portion of the access road system from the 400 series highways to the site and the roads between sites are referred to as the local and regional access roads. The province-wide access system refers to the total access system to the candidate sites excluding the local and regional access roads.

3. acute exposure: Exposure of short duration, as opposed to chronic.

4. additives and reagents: The treatment of special wastes prior to disposal in a landfill site requires the use of reagents and additives (e.g. cement, sodium silicate, hydrated lime).

5. Adjusted Margin of Safety (AMOS): Estimate of the largest amount of chemical exposed on a daily basis which is not anticipated to result in adverse effects (usually expressed in mg/kg/day) divided by the actual amount of human exposure in a population.

6. aggregation: Aggregation refers to a numerical procedure for combining measures of importance (factor rankings with measures of risk and impact magnitude) (factor suitability levels)).

7. aggregation of factors: The process of combining all factors of a specific siting option to produce a composite siting option suitability by Factor Grouping.

8. aggregation of indicators: The process of combining all indicators for one factor to produce factor suitability levels. Indicators are aggregated for each factor for each siting option.

9. air dispersion zones: Refers to two air quality zones employed in the air quality monitoring work. The zones are 0-5 km for fugitive or low elevation releases and 0-20 km for stack emissions studies.

10. basic acceptability analysis: A step in the evaluation process that involves an assessment of the acceptability of siting options to ensure that they meet basic agency requirements and taking into consideration major new constraints identified as a result of Phase 4A data collection.

11. boundary refinement: The process of redefining site boundaries for certain candidate sites. Candidate sites PI-1N, LF-3C and LF-1E underwent boundary refinement.

12. carcinogen: A substance that increases the risk of cancer.

13. Case 1: The option of locating the physical/chemical treatment plant, the incineration plant and the engineered landfill on one site.

14. Case 2: The option of locating the physical/chemical treatment plant with the incineration plant for partially integrated siting options.

15. Case 3: The option of locating the physical/chemical treatment plant with the engineered landfill site for partially integrated siting options.

16. chronic exposure: Exposure of long term duration, as opposed to acute.

17. community and regional area: The community and regional area is the broader study area surrounding the site vicinity boundary. This was defined in various ways by the site selection consultants. The general approach used by consultants to define the study area was to use well-defined boundaries, e.g. air dispersion zones, municipalities.

18. conservative assumption: Assumptions which are conservative in the sense of overestimating possible human health risk and impacts.

19. constraints: Constraints are limitations imposed on the use of the land by a specific feature which is potentially incompatible with the siting of OWMC facilities.

20. constraint mapping: Constraint mapping is a method of analysis that involves identification of factors that may pose constraints to development, collection of data, mapping of data on "constraint maps", and the identification of areas not excluded by constraints shown on the maps. For example, this method could be used to identify the preferred location for siting a facility.

21. constant marginal utility: Constant marginal utility occurs when successive units of impact or risk are assumed to cause a constant increase in total impact or risk. This is in contrast to a situation where, for example, a threshold exists above which total impacts increase at a much faster rate for each unit of impact.

22. data matrices: Data matrices are tables recording the raw data or information collected for each siting option. The data corresponds to each factor and indicator.

23. dose: Measurement of the amount received by the subject, whether human or animal, per unit of body weight.

24. dose-response evaluation: A component of risk assessment that describes the quantitative relationship between the amount of exposure to a substance and the extent of toxic injury or disease.

25. epidemiological study: Study of human populations to identify causes of disease. Such studies often compare the health status of a group of persons who have been exposed to a suspect agent with that of a comparable nonexposed group.

26. exposure: To be accessible to the influence of a chemical or chemical action.

27. facilities characteristic assumptions: Are descriptions of key elements of the proposed undertaking.

28. factor: Each factor represents a positive or negative consideration which would assist in comparing siting options. The factors refer to risks, impacts or engineering considerations. Two examples of factors include social cohesion and capital cost.

29. factor grouping: The factor groupings are groups of factors. An example of a factor grouping would be hydrogeologic suitability. The hydrogeologic suitability factor grouping is composed of two factors - natural containment and ground water use.

30. factor ranking: In order for the site selection team to compare siting options using the factors, it is necessary to consider the relative importance of the factors. The process of establishing the relative importance of each factor is called factor ranking.

31. factor scores: The sum of the products of factor ranking and factor suitability levels.

32. factor suitability level: Is the relative level of constraint associated with a factor occurrence within a particular study area for a particular siting option.

33. feature: A feature includes all man-made structures (e.g. residences, farm complexes) and natural environmental resources located either on-site or off-site.

34. fugitive emissions: Fugitive emissions are any air pollutants emitted to the atmosphere other than from the stack (e.g. dust from trucks, and emissions escaping as drums are opened).

35. generic risk assessment: The scientific activity of evaluating the toxic properties of a chemical and the conditions of human exposure to it, both to ascertain the likelihood that exposed humans will be adversely affected, and to characterize the nature of the effects they may experience. The term generic indicates that the risk assessment has used a single set of generalized site parameters applicable to all sites rather than characteristics specific to each candidate site.

36. geographic cluster: Geographic cluster refers to the grouping of the siting options by location - Milton, West Lincoln and Niagara Falls, prior to the comparison of siting options. The siting options located within geographic cluster were compared and a preferred siting option for each geographic cluster was identified.

37. goals: The goals address broad areas of consideration in site selection and have been developed and adopted by OWMC to guide the process of identifying and evaluating candidate sites. The three goals, ranked in order of importance, are:

(i) to minimize risk to human health;
(ii) to minimize environmental impact; and
(iii) to minimize financial costs to OWMC and the people of Ontario.

38. hazard evaluation: A component of risk assessment which involves gathering and evaluating data on the types of health injury or disease (e.g. cancer) that may be produced a chemical and on the conditions of exposure under which injury or disease is produced.

39. human exposure evaluation: A component of risk assessment that involves describing the nature and size of population exposed to a substance and the magnitude and duration of their exposure. The evaluation could concern past exposures, current exposures or anticipated exposures.

40. human health risk: The likelihood (or probability) that a given exposure or series of exposures may have or will damage the health of individuals experiencing the exposures.

41. hypothetical best siting option: The hypothetical best siting option represents the sum of the best factor suitability levels across the the siting options.

42. impact: Impact refers to the effect or influence that the introduction of the OWMC facility may have. Impacts may be either positive or negative.

43. indicators: Factors are subdivided into indicators. Indicators are ways of more precisely identifying, describing and predicting risks, impacts and engineering cost concerns. Examples of indicators for the factor "surface water suitability" are downstream surface water use and transport spill entry to a stream.

44. ingestion: Type of exposure through the mouth.

45. inhalation: Type of exposure through the lungs.

46. lifetime of exposure: Total amount of exposure to a substance that a human would receive in a lifetime (usually assumed to be seventy years).

47. local and regional access road: That portion of the access route between the 400 series highway and the facility.

48. Margin-of-Safety (MOS): Maximum amount of exposure producing no measurable effect in animals (or studied humans) divided by the actual amount of human exposure in a population.

49. mathematical model: Model used during risk assessment to perform extrapolations.

50. mitigation: Mitigation refers to methods that may be used to prevent, avoid or reduce the severity of risks, impacts or engineering cost concerns. Examples of mitigative measures are flood control measures, and noise control.

51. No-Observed Adverse Effect Level (NOAEL): Dose level at which no adverse response is observed.

52. objectives: Objectives represent a refinement and elaboration of goals. In the case of the goal of minimizing environmental impacts, for example, the objectives specify different elements of the environment to be protracted.

53. partial solidification: Partial solidification is an operating mode in which excess treated effluent from the physical/chemical treatment plant is discharged off-site rather than being solidified and disposed of along with other residues in the engineered landfill.

54. public consultation: The public consultation program consisted of a series of meetings and workshops where individuals and groups, who are directly or indirectly impacted by the siting of an OWMC facility, were able to review and submit their comments on the various stages of the site selection decision-making process.

55. 170 m and 250 m rail access impact zones: Rail access impact zones are 170-metre and 250-metre zones abutting each side of potential rail spur lines.

56. ranking of indicators: Ranking of indicators refers to the assignment of a numeric value to an indicator to establish the relative importance of that indicator within a particular factor.

57. ranking of siting options: Ranking of siting options is the final step in the evaluation process. In this step the relative suitability of the siting options is determined.

58. rare species: Are those plants and animals which have a limited population and distribution in an area.

59. risk: Probability of injury, disease, or death under specific circumstances.

60. risk pathway: A risk pathway is a route of exposure of contaminants to humans. Examples are air (inhalation of contaminants), surface water (ingestion, skin absorption) and ground water (ingestion).

61. scaling: The conversion of data to units of desirability, such as high, medium or low.

62. screening of factors and indicators: Screening of factors and indicators refers to a step in the evaluation process in which factors and indicators were dropped from the analysis where there were no risks, impacts or costs for all siting options, where there were no differences among options or where it was not possible to put the indicator into effect.

63. sensitivity analyses: Sensitivity analyses are evaluation methods to determine the effect of different facility assumptions (e.g. rail versus road access, total versus partial solidification) on the ranking of the siting options.

64. SEU: SEU is a short form for Sensitive Environmental Units. SEUs include Environmentally Significant Areas, Areas of Natural and Scientific Interest, and Areas of Important Biological Resources, all of which have been designated in published reports.

65. site: Site refers to the eight candidate sites identified at the end of Phase 3B (i.e. LF-9C, LF-3C, LF-1E, PI-27E, PI-1N, PI-13N, LF-4N, LF-2N).

66. site acquisition area: The area identified in Phase 3B and further refined in Phase 4A, required for the location of facilities, including any buffer zones.

67. site vicinity: Site vicinity refers to the study area used around each of the candidate sites. This area extends approximately 2 km. from the centre of each candidate site.

68. siting option: Siting option refers to the combination of sites required to accommodate all OWMC facilities. An integrated siting option involves all facilities located on one site. For a partially integrated option, two sites are required to accommodate the facilities (i.e. landfill (one site), incinerator (alternate site) and physical/chemical treatment plant (paired with either the landfill or incinerator). The options under consideration at the beginning of Phase 4A were LF-9C, LF-3C, LF-4N/PI-1N, LF-4N/PI-13N, LF-2N/PI-1N, LF-2N/PI-13N, LF-1E, and LF-1E/PI-27E.

69. special waste: Industrial wastes that cannot be adequately dealt with by the existing public facilities, such as municipal sewage treatment plants, municipal incinerators and municipal landfills. Radioactive wastes and municipal wastes are excluded from this definition.

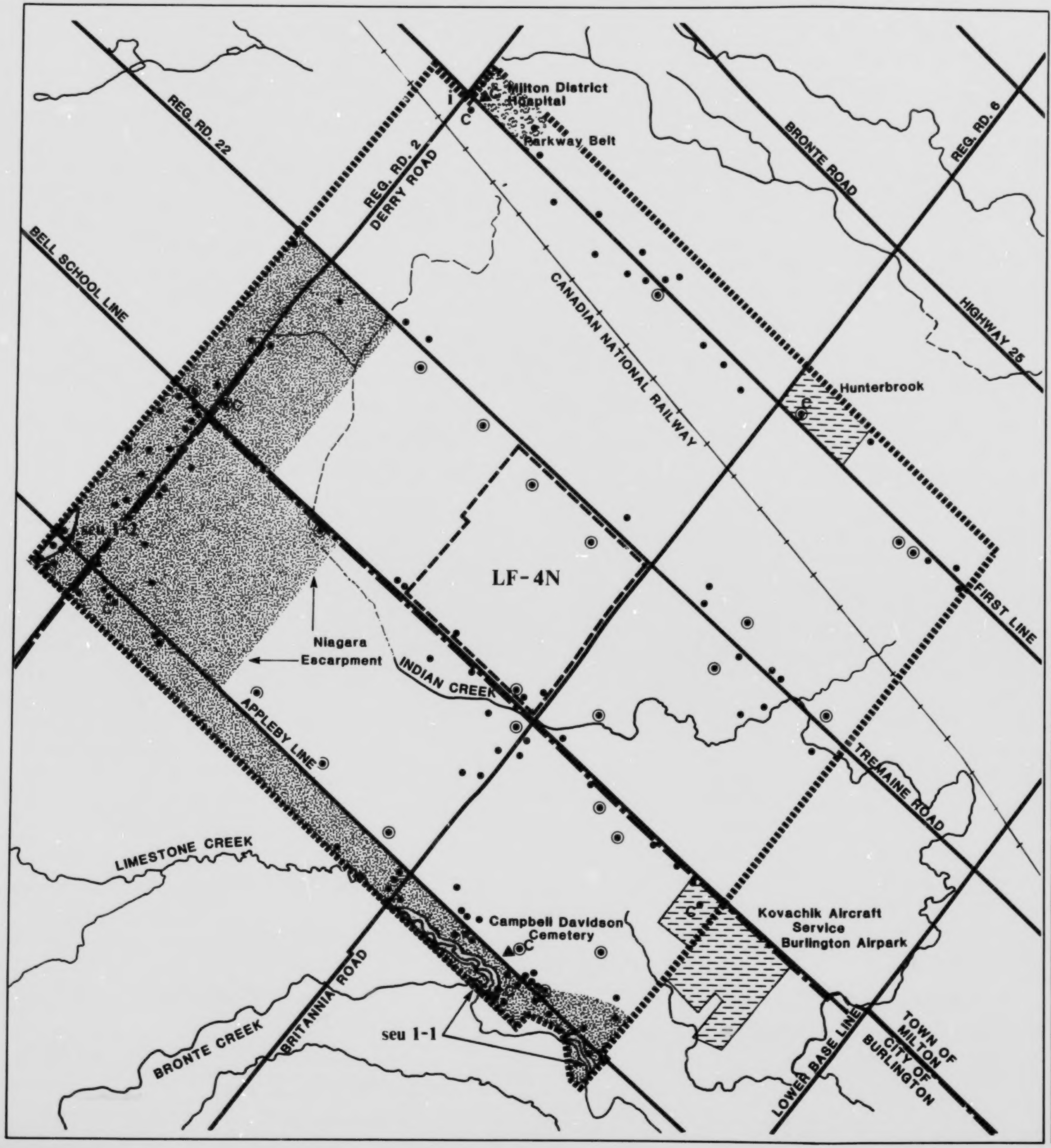
70. study areas: Various study areas were chosen for use by all consultants during the evaluation process. Study areas considered included the site, site vicinity, rail and road access, air dispersion zones and the community and regional study areas.

71. subindicators: Indicators can be divided into subindicators. Subindicators usually represent ways of measuring or providing a finer breakdown of indicators. For example, under the community and regional economic base factor, "area municipality" and "regional municipality" are subindicators for the indicator "number of additional households created".

72. total solidification: Total solidification refers to an operating mode in which excess treated effluent from the physical/chemical treatment plant is solidified and disposed of, along with other residues, in the engineered landfill. The Phase 4A site selection process assumed a total solidification treatment process.

73. toxic: Harmful in regard to the effects of chemicals.

74. tradeoffs: A tradeoff represents a matching of the differences between pairs of siting options. An example of a tradeoff between LF-9C in West Lincoln and LF-4N/PI-1N in Milton is the importance of transportation risk favouring LF-4N/PI-1N against hydrogeologic suitability and air quality favouring LF-9C.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REG. RD. 2
DERRY ROAD
BRONTE ROAD
REG. RD. 6
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CANADIAN NATIONAL RAILWAY
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LF-4N
FIRST LINE
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Niagara Escarpment
INDIAN CREEK
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LIMESTONE CREEK
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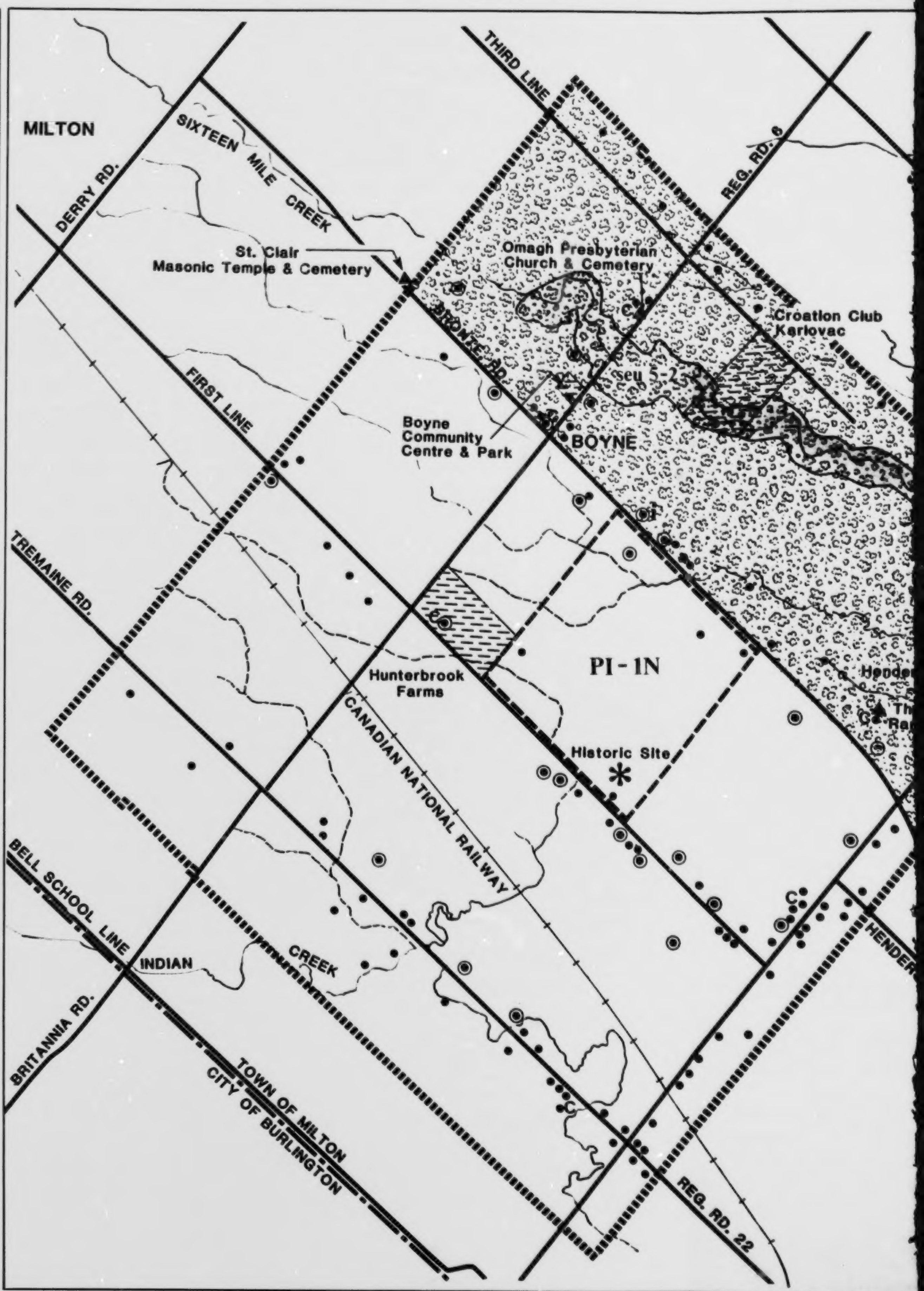
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SIXTEEN MILE CREEK
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St. Clair Masonic Temple & Cemetery
Omagh Presbyterian Church & Cemetery
Croation Club Karlovac
BRONTE RD.
seu 1-3
FIRST LINE
Boyne Community Centre & Park
BOYNE
TREMAINE RD.
Hunterbrook Farms
PI-1N
CANADIAN NATIONAL RAILWAY
Historic Site
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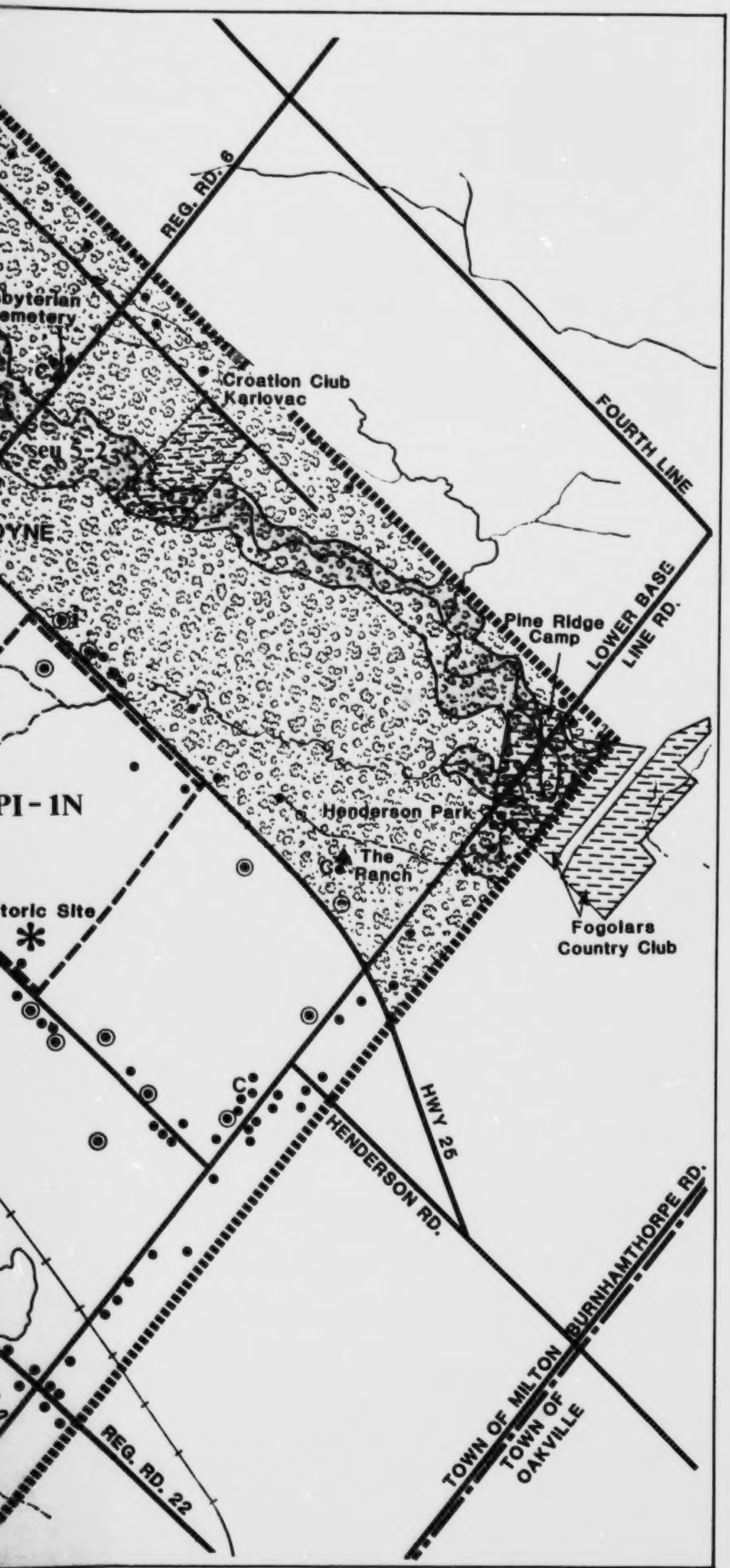

REG. RD. 6
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FOURTH LINE
DYNE
LOWER BASE LINE RD.
Pine Ridge Camp
PI-1N
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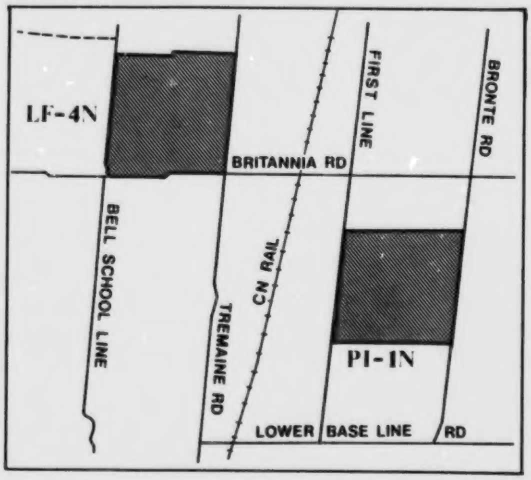
The Ranch
Historic Site
Fogolars Country Club
C
HWY 25
HENDERSON RD.
BURNHAMTHORPE RD.
TOWN OF MILTON
TOWN OF OAKVILLE
REG. RD. 22

OWMC Ontario Waste Management Corporation

Legend

- ▬ ▬ Acquisition Area Boundary
- ▮▮▮▮▮ Phase 4A Site Vicinity Study Area Boundary
- ▪▬ Municipal Boundary
- ● Residences
- ○ Farm Buildings
- C Commercial Uses
- ▤ Community and Recreation Feature
- i Industrial Use
- ▨ seu (Significant Environmental Unit)
- ▒ Parkway Belt

Key Map



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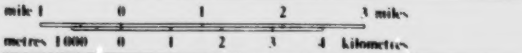
TREMAINE RD
CN RAIL
FIRST LINE
BRONTE RD
PI-1N
LOWER BASE LINE RD



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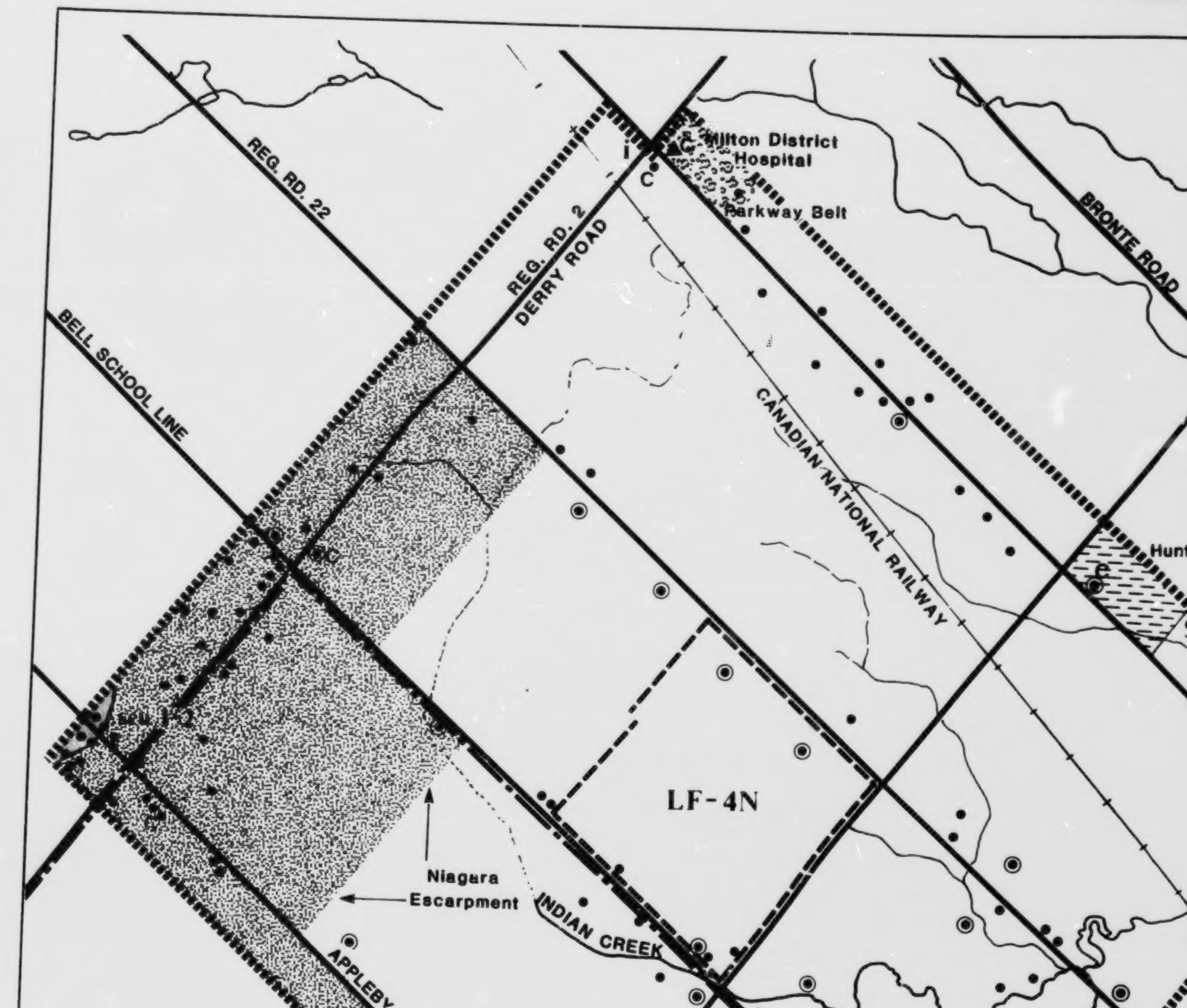
Major Features Phase 4A

Siting Option LF-4N/PI-1N

MAP 1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Niagara Escarpment
INDIAN CREEK
APPLEBY LINE
LIMESTONE CREEK
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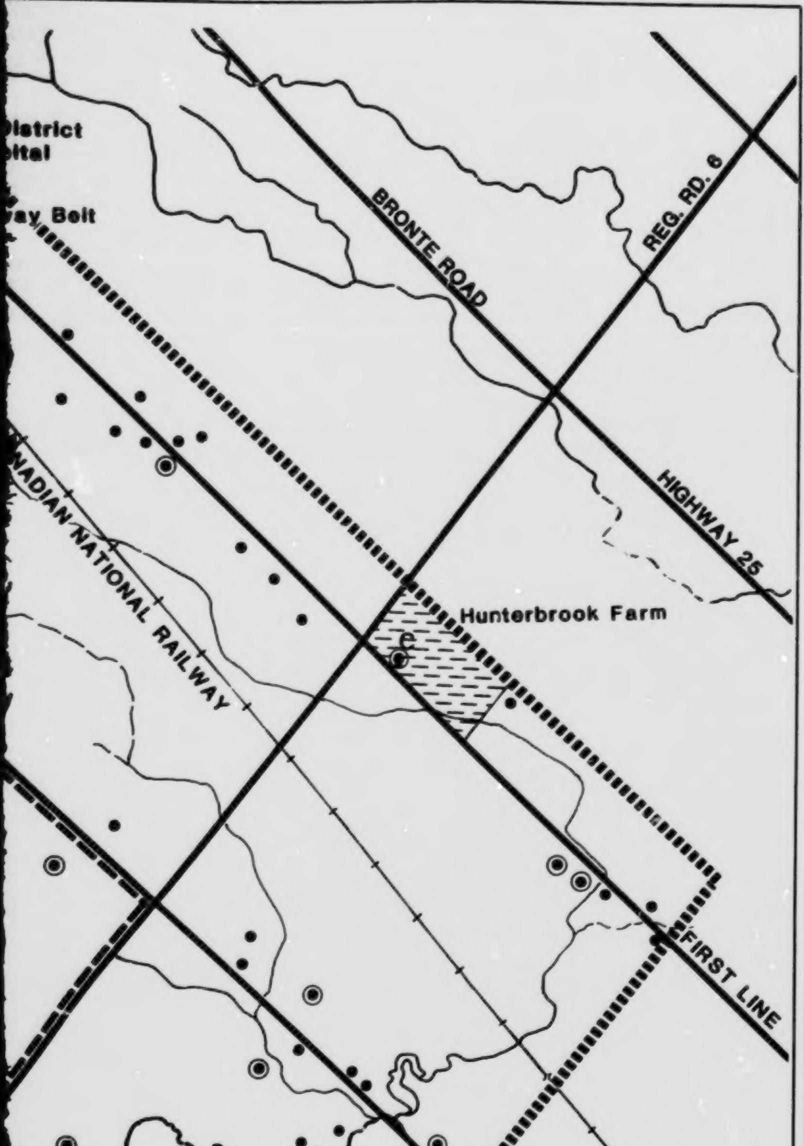
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Burlington Airpark
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Davidson
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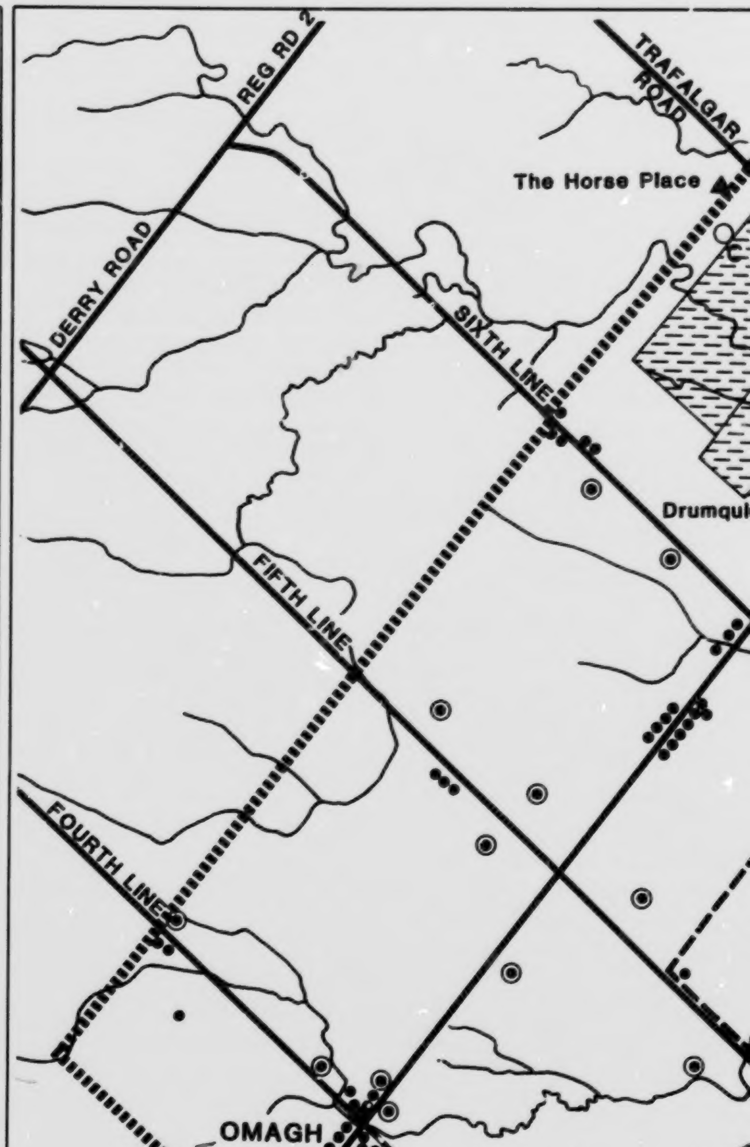
LOWER BASE LINE
TOWN OF
MILTON
CITY OF
BURLINGTON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TRAFALGAR
ROAD
The Horse Place
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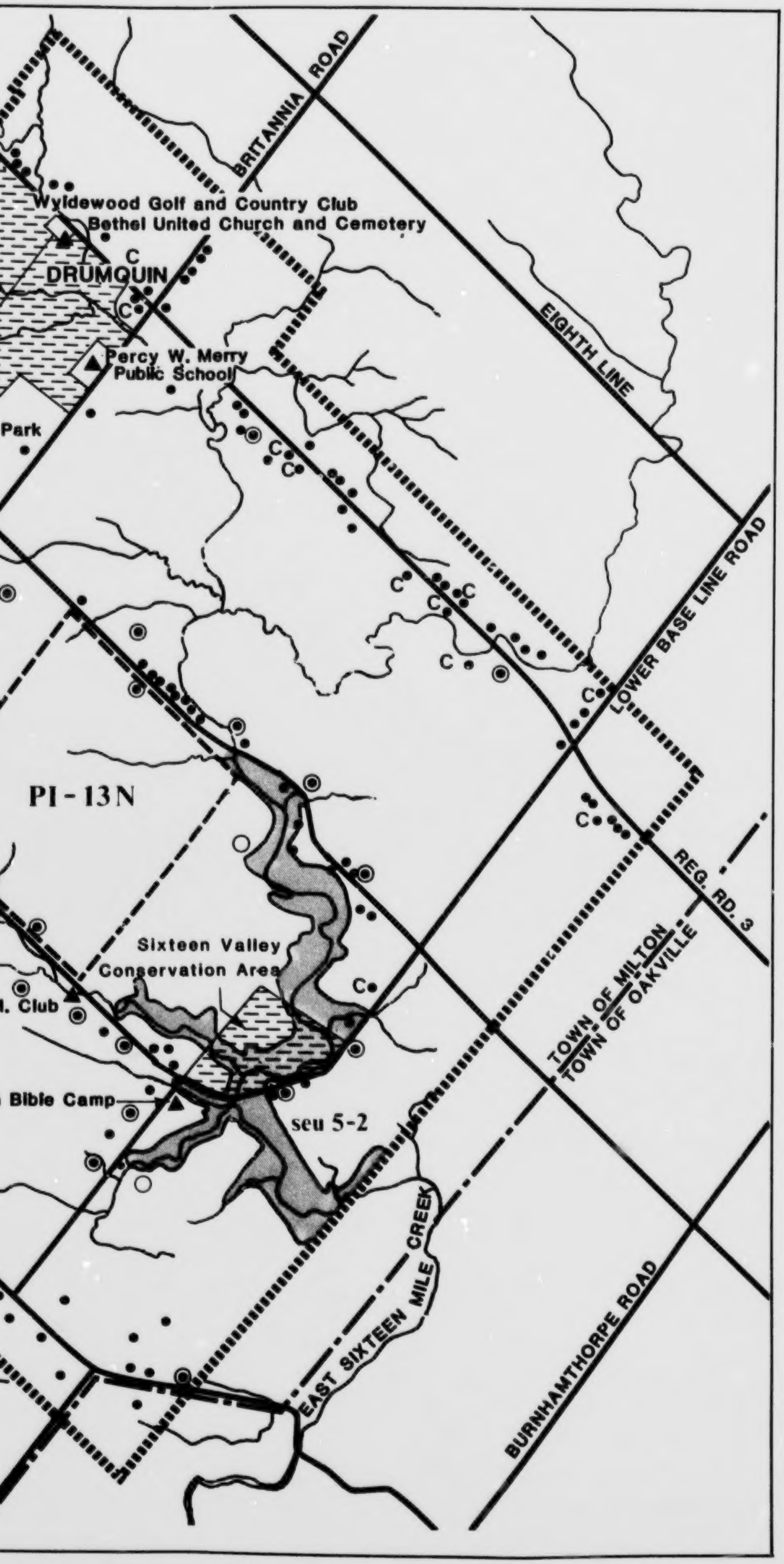
DERRY ROAD
SIXTH LINE
Drumqui
FIFTH LINE
FOURTH LINE
OMAGH
Church of Christ
and Cemetery
Omagh
Community Park
S.O
Omag
C
C
REG. RD. 6
THIRD LINE
BOYNE
HWY. 25



BRITANNIA ROAD
EIGHTH LINE
Wyldewood Golf and Country Club
Bethel United Church and Cemetery
DRUMQUIN
Percy W. Merry Public School
Park
LOWER BASE LINE ROAD
PI - 13N
REG. RD. 3
Sixteen Valley Conservation Area
Club
Bible Camp
seu 5-2
TOWN OF MILTON
TOWN OF OAKVILLE
EAST SIXTEEN MILE CREEK
BURNHAMTHORPE ROAD
C
N

OWMC Ontario Waste Management Corporation

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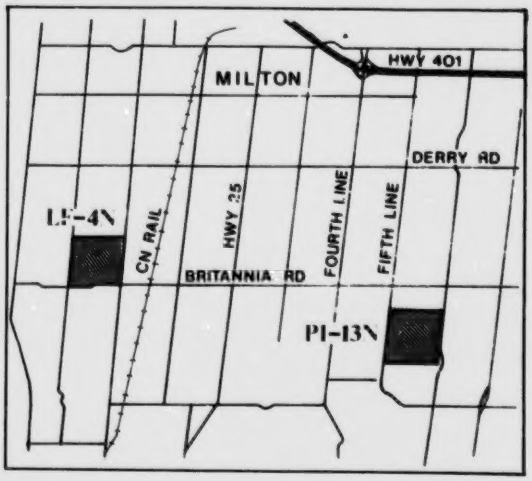
Key Map



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DERRY RD
LF-4N
CN RAIL
HWY 25
FOURTH LINE
FIFTH LINE
BRITANNIA RD
PI-13N

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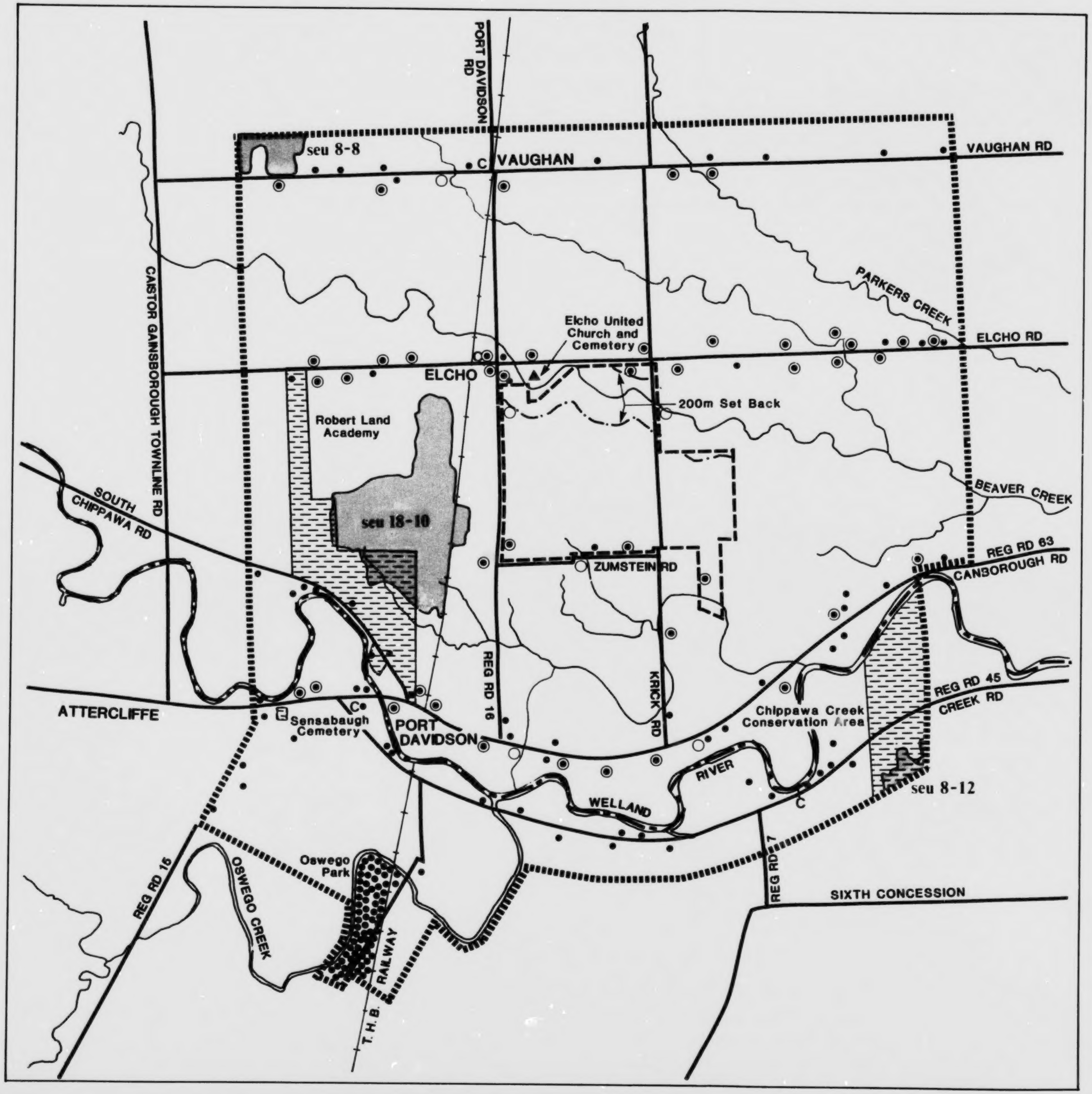
metres 1000 0 1 2 3 4 kilometres

Major Features Phase 4A

Siting Option LF-4N/PI-13N

MAP 2


PORT DAVIDSON RD
CAISTOR GAINSBOROUGH TOWNLINE RD
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VAUGHAN
VAUGHAN RD
PARKERS CREEK
ELCHO RD
Elcho United Church and Cemetery
ELCHO
Robert Land Academy
200m Set Back
SOUTH CHIPPAWA RD
seu 18-10
BEAVER CREEK
REG RD 63
CANBOROUGH RD
ZUMSTEIN RD
REG RD 16
KRICK RD
REG RD 45
CREEK RD
Chippawa Creek Conservation Area
ATTERCLIFFE
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Sensabaugh Cemetery
PORT DAVIDSON
WELLAND RIVER
C
seu 8-12
Oswego Park
OSWEGO CREEK
REG RD 16
T. H. B. RAILWAY
REG RD 7
SIXTH CONCESSION

OWMC Ontario Waste Management Corporation

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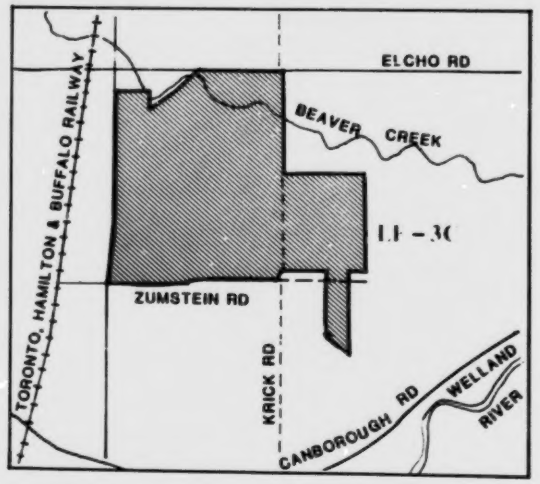
- ▨ seu (Significant Environmental Unit)

Key Map

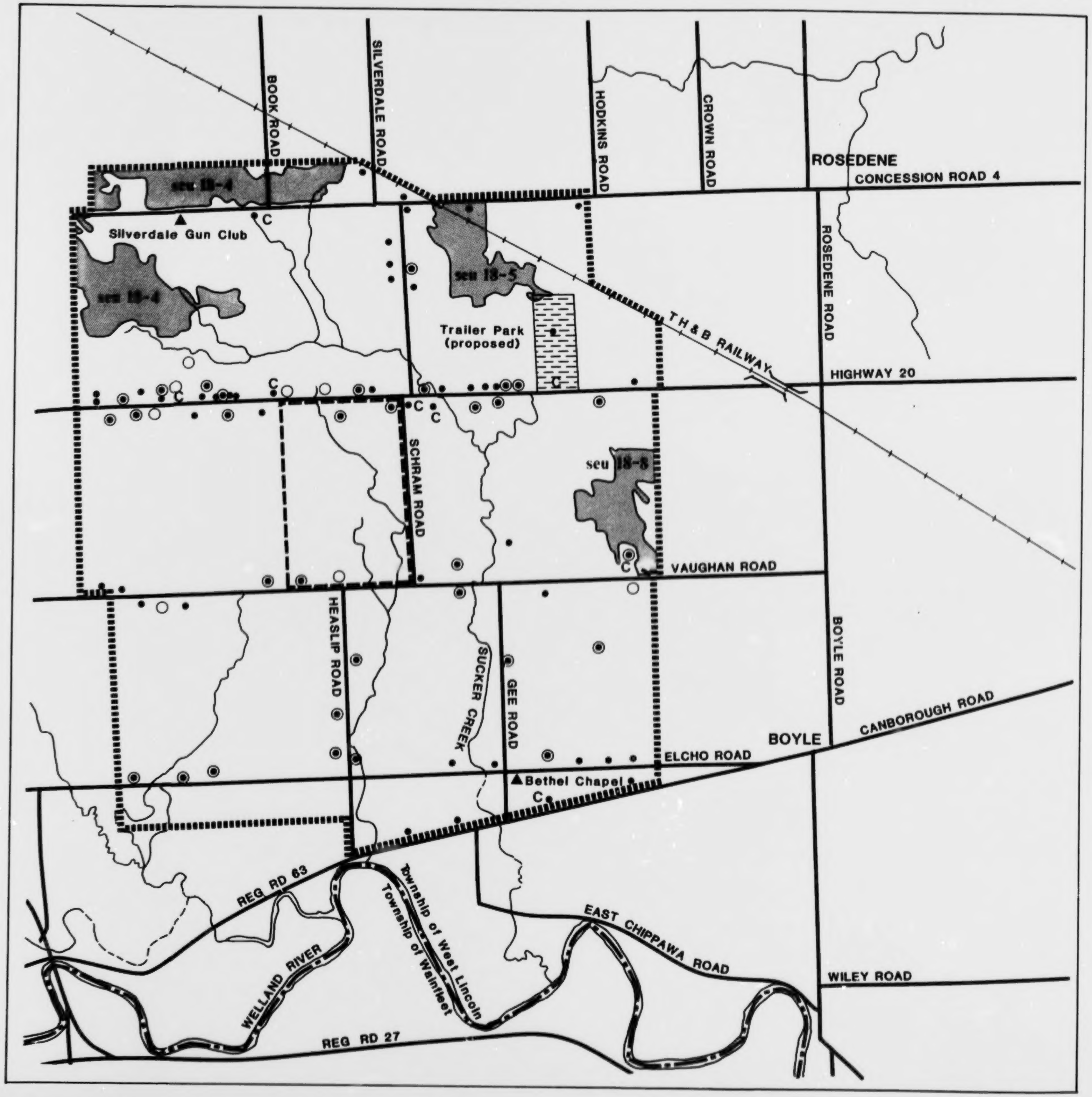

ELCHO RD
TORONTO, HAMILTON & BUFFALO RAILWAY
BEAVER CREEK
LF - 3C
ZUMSTEIN RD
KRICK RD
CANBOROUGH RD
WELLAND RIVER

mile 1 0 1 2 3 miles
metres 1000 0 1 2 3 4 kilometres

Major Features Phase 4A

Siting Option LF - 3C

MAP 3

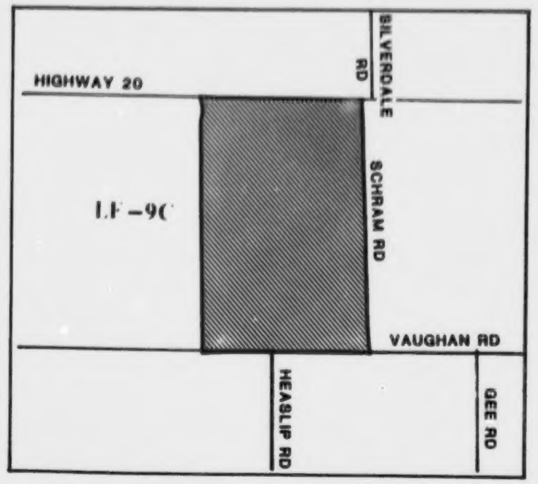

BOOK ROAD
SILVERDALE ROAD
HOKKINS ROAD
CROWN ROAD
ROSEDENE
CONCESSION ROAD 4
seu 18-4
Silverdale Gun Club
C
seu 18-4
seu 18-5
Trailer Park (proposed)
T H & B RAILWAY
ROSEDENE ROAD
HIGHWAY 20
SCHRAM ROAD
seu 18-8
VAUGHAN ROAD
HEASLIP ROAD
SUCKER CREEK
GEE ROAD
BOYLE ROAD
CANBOROUGH ROAD
BOYLE
ELCHO ROAD
Bethel Chapel
REG RD 63
Township of West Lincoln
Township of Wainfleet
EAST CHIPPAWA ROAD
WILEY ROAD
WELLAND RIVER
REG RD 27

OWMC Ontario Waste Management Corporation

Legend

- ▬ ▬ Acquisition Area Boundary
- ▪▪▪▪ Phase 4A Site Vicinity Study Area Boundary
- ▬ · ▬ Municipal Boundary
- ● Residences
- ○ Farm Buildings
- C Commercial Uses
- ▤ Community and Recreation Feature
- i Industrial Use
- ▨ seu (Significant Environmental Unit)

Key Map

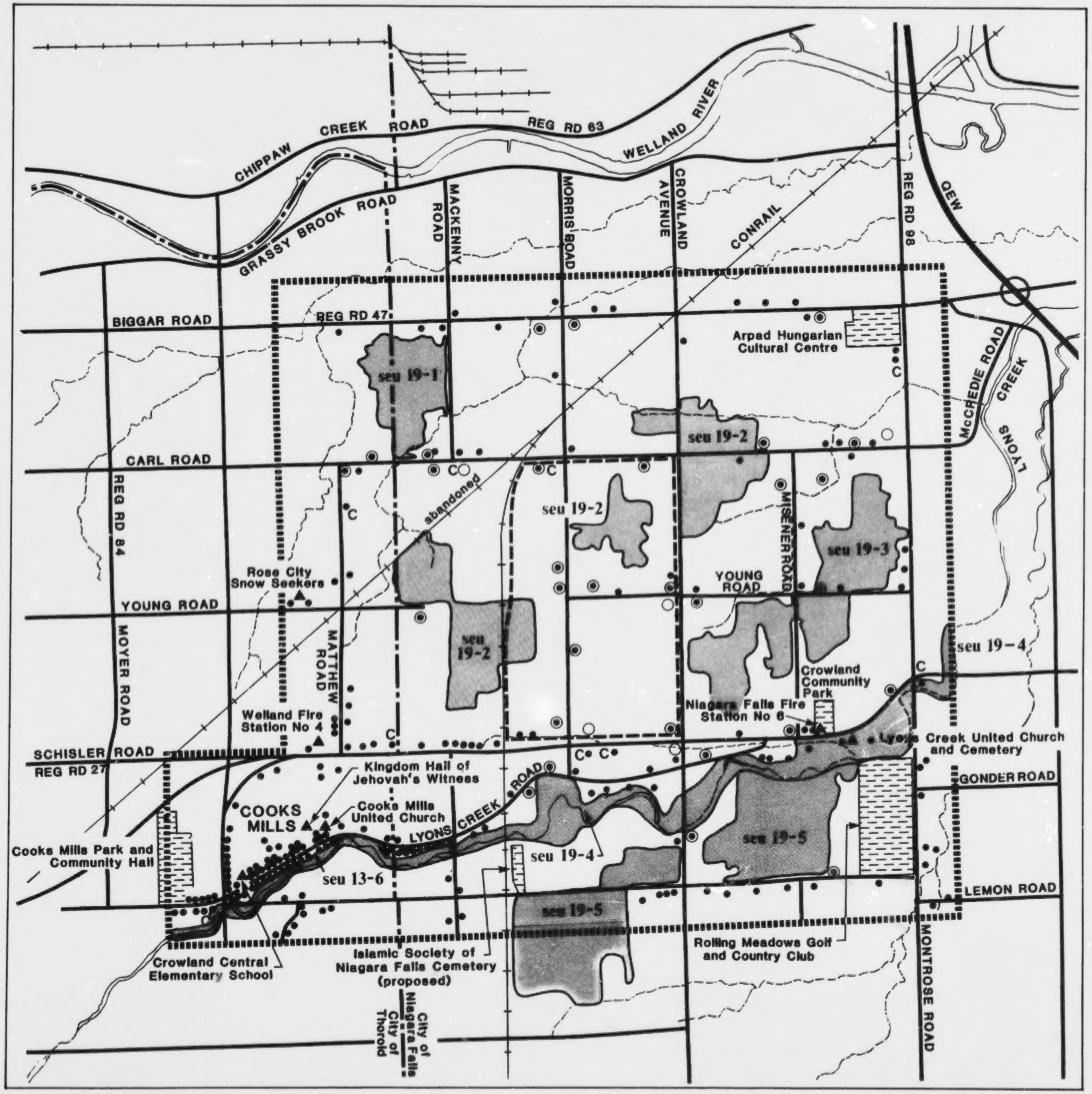

HIGHWAY 20
SILVERDALE RD
LF-9C
SCHRAM RD
VAUGHAN RD
HEASLIP RD
GEE RD

mile 1 0 1 2 3 miles
metres 1000 0 1 2 3 4 Kilometres

Major Features Phase 4A

Siting Option LF-9C

MAP 4


CHIPPAW CREEK ROAD
REG RD 63
WELLAND RIVER
GRASSY BROOK ROAD
MACKENNY ROAD
MORRIS ROAD
CROWLAND AVENUE
CONRAIL
REG RD 98
QEW
BIGGAR ROAD
REG RD 47
Arpad Hungarian Cultural Centre
McCREDIE ROAD
LYONS CREEK
seu 19-1
seu 19-2
CARL ROAD
abandoned
seu 19-2
seu 19-3
MISENER ROAD
YOUNG ROAD
REG RD 84
Rose City Snow Seekers
YOUNG ROAD
MOYER ROAD
MATTHEW ROAD
seu 19-2
seu 19-4
Crowland Community Park
Welland Fire Station No 4
Niagara Falls Fire Station No 6
Lyons Creek United Church and Cemetery
SCHISLER ROAD
REG RD 27
Kingdom Hall of Jehovah's Witness
GONDER ROAD
COOKS MILLS
Cooks Mills United Church
LYONS CREEK ROAD
seu 19-5
Cooks Mills Park and Community Hall
seu 19-4
seu 13-6
LEMON ROAD
seu 19-5
Crowland Central Elementary School
Islamic Society of Niagara Falls Cemetery (proposed)
Rolling Meadows Golf and Country Club
MONTROSE ROAD
City of Thorold
City of Niagara Falls
C

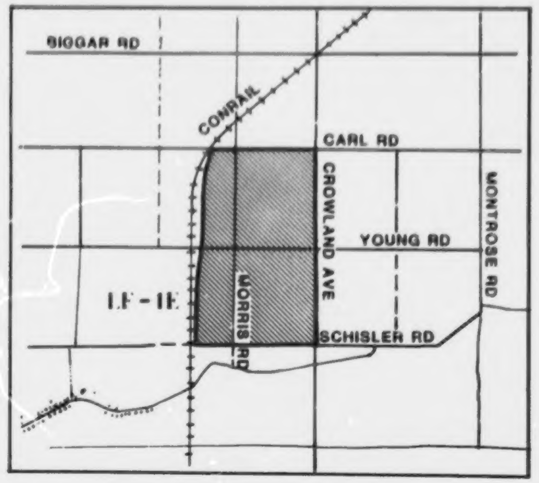
OWMC Ontario Waste Management Corporation

Legend

- ▬ ▬ Acquisition Area Boundary
- ▪▪▪▪ Phase 4A Site Vicinity Study Area Boundary
- ▬ · ▬ Municipal Boundary
- ● Residences
- ○ Farm Buildings
- C Commercial Uses
- ▤ Community and Recreation Feature
- i Industrial Use
- ▨ seu (Significant Environmental Unit)

N

Key Map

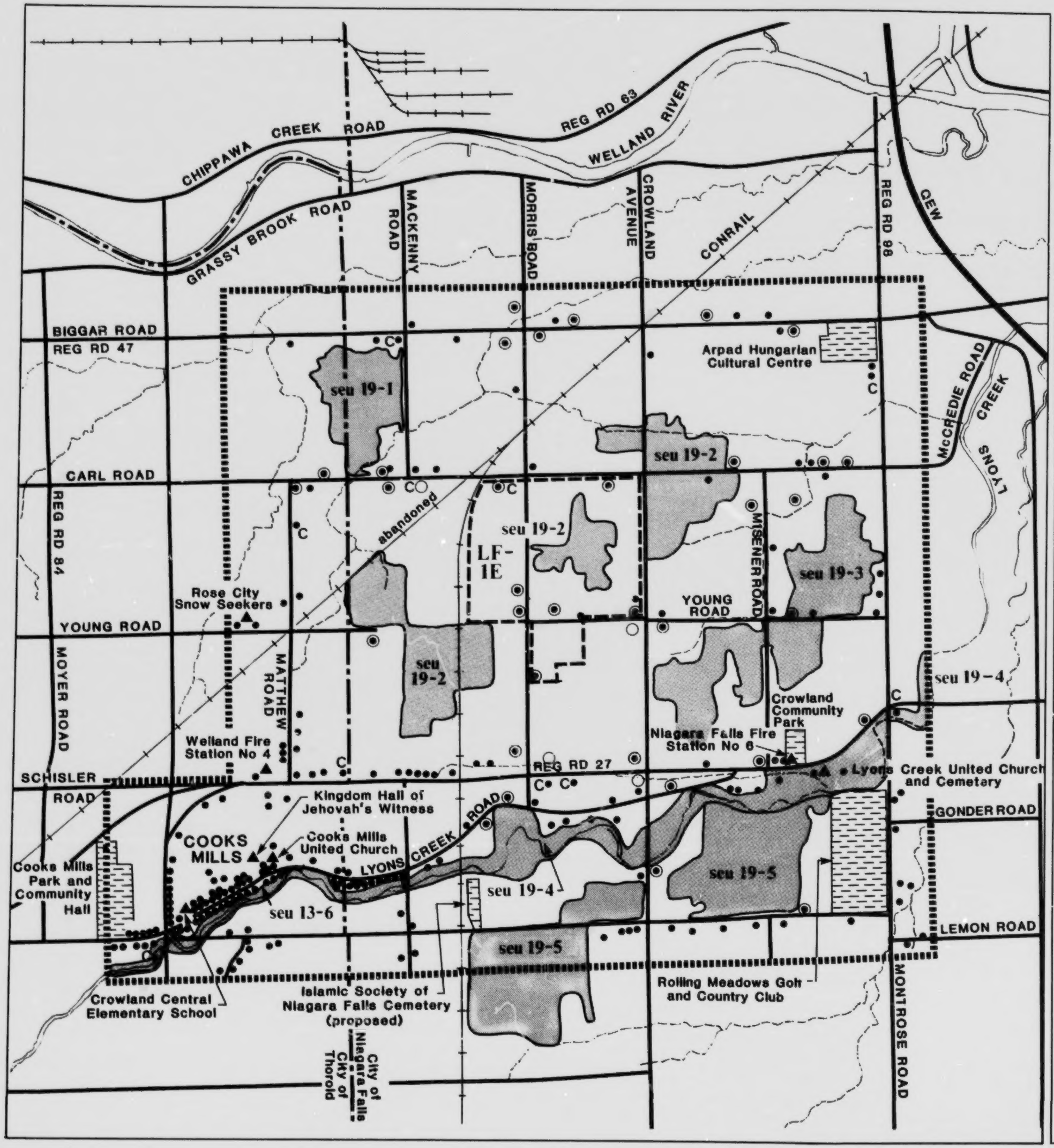

BIGGAR RD
CONRAIL
CARL RD
CROWLAND AVE
MONTROSE RD
YOUNG RD
LF-1E
MORRIS RD
SCHISLER RD

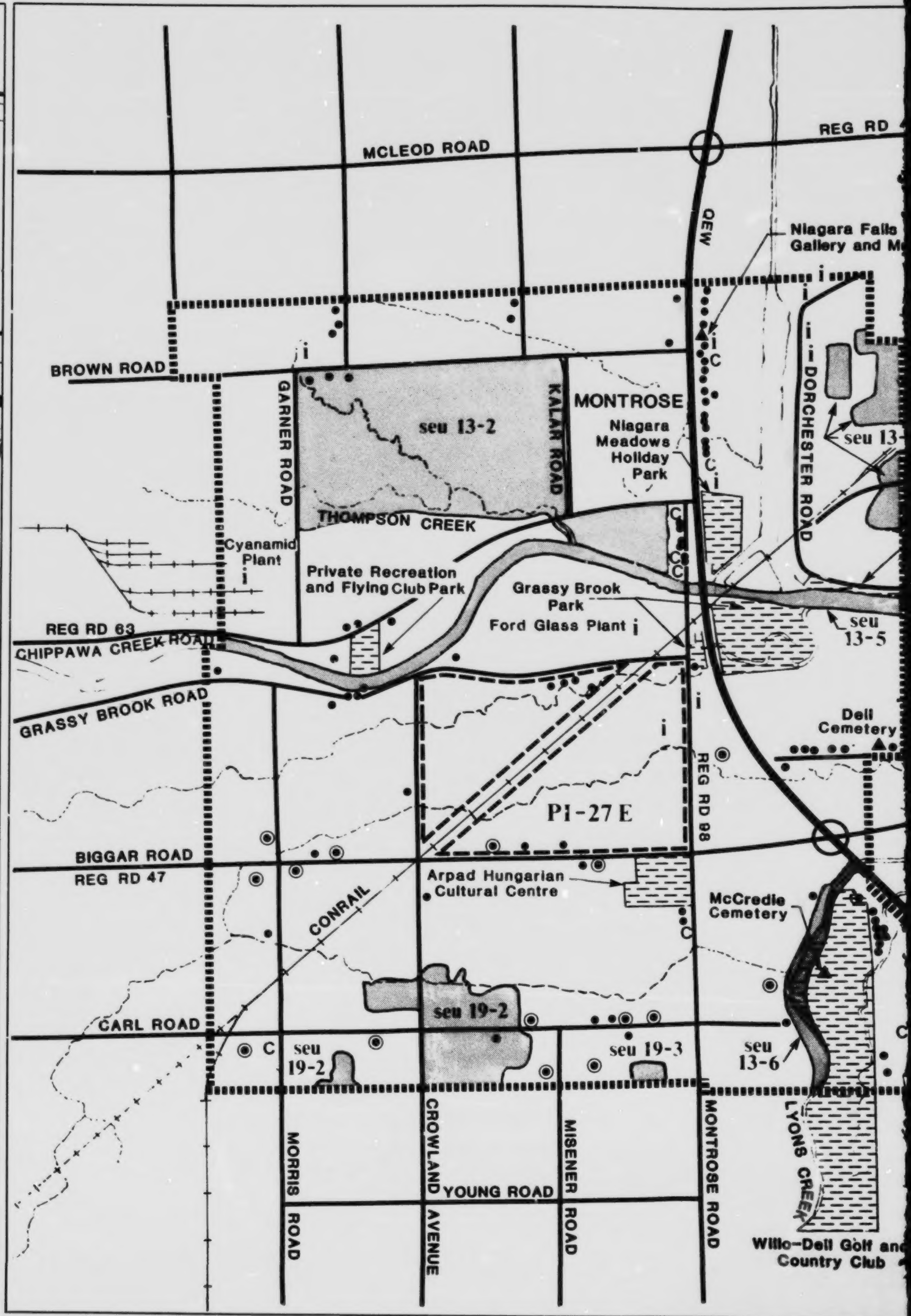
mile 1 0 1 2 3 miles
metres 1000 0 1 2 3 4 Kilometres

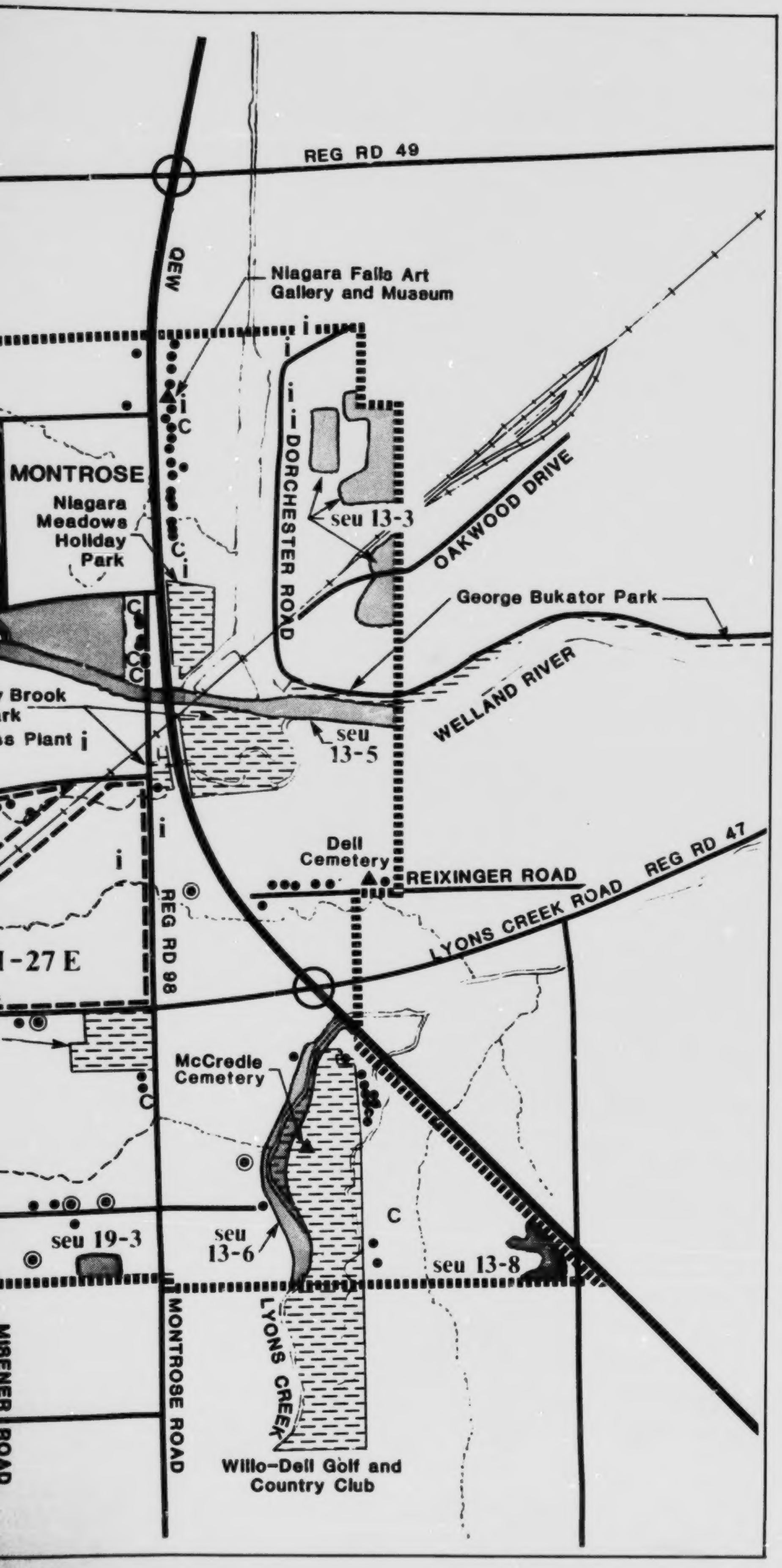
Major Features Phase 4A

Siting Option LF-1E

MAP 5


CHIPPAWA CREEK ROAD
REG RD 63
WELLAND RIVER
GRASSY BROOK ROAD
CONRAIL
MACKENNY ROAD
MORRIS ROAD
CROWLAND AVENUE
REG RD 98
QEW
BIGGAR ROAD
REG RD 47
Arpad Hungarian Cultural Centre
McCREDIE ROAD
LYONS CREEK
seu 19-1
seu 19-2
CARL ROAD
REG RD 84
abandoned
LF-1E
MISENER ROAD
seu 19-3
YOUNG ROAD
Rose City Snow Seekers
seu 19-4
MOYER ROAD
MATTHEW ROAD
Crowland Community Park
Niagara Falls Fire Station No 6
Welland Fire Station No 4
SCHISLER ROAD
REG RD 27
Lyons Creek United Church and Cemetery
Kingdom Hall of Jehovah's Witness
GONDER ROAD
COOKS MILLS
Cooks Mills United Church
LYONS CREEK ROAD
Cooks Mills Park and Community Hall
seu 13-6
seu 19-5
LEMON ROAD
Crowland Central Elementary School
Islamic Society of Niagara Falls Cemetery (proposed)
Rolling Meadows Golf and Country Club
MONTROSE ROAD
City of Niagara Falls
City of Thorold
C


REG RD
MCLEOD ROAD
QEW
Niagara Falls Gallery and M
BROWN ROAD
GARNER ROAD
seu 13-2
KALAR ROAD
MONTROSE
Niagara Meadows Holiday Park
DORCHESTER ROAD
seu 13
THOMPSON CREEK
Cyanamid Plant
Private Recreation and Flying Club Park
Grassy Brook Park
Ford Glass Plant
REG RD 63
CHIPPAWA CREEK ROAD
seu 13-5
GRASSY BROOK ROAD
Dell Cemetery
P1-27 E
REG RD 98
BIGGAR ROAD
REG RD 47
Arpad Hungarian Cultural Centre
CONRAIL
McCredie Cemetery
CARL ROAD
seu 19-2
seu 19-3
seu 13-6
MORRIS ROAD
CROWLAND AVENUE
YOUNG ROAD
MISENER ROAD
MONTROSE ROAD
LYONS CREEK
Willo-Dell Golf and Country Club
C
i

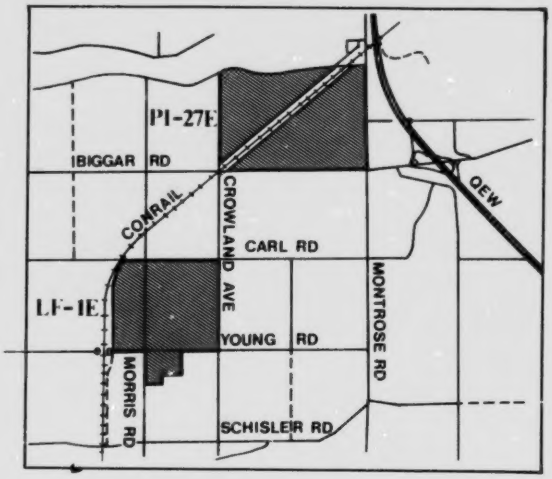

REG RD 49
QEW
Niagara Falls Art Gallery and Museum
MONTROSE
Niagara Meadows Holiday Park
DORCHESTER ROAD
seu 13-3
OAKWOOD DRIVE
George Bukator Park
WELLAND RIVER
Brook
rk
s Plant i
seu 13-5
Dell Cemetery
REIXINGER ROAD
REG RD 47
LYONS CREEK ROAD
REG RD 98
I-27 E
McCredie Cemetery
C
i
seu 19-3
seu 13-6
seu 13-8
MONTROSE ROAD
LYONS CREEK
MISENER ROAD
Willo-Dell Golf and Country Club

OWMC Ontario Waste Management Corporation

Legend

- — — Acquisition Area Boundary
- ▪▪▪▪▪ Phase 4A Site Vicinity Study Area Boundary
- -— Municipal Boundary
- ● Residences
- ○ Farm Buildings
- C Commercial Uses
- ▤ Community and Recreation Feature
- i Industrial Use
- ▨ seu (Significant Environmental Unit)
- ○ Interchange

Key Map


PI-27E
BIGGAR RD
CONRAIL
CROWLAND AVE
CARL RD
MONTROSE RD
QEW
LF-1E
YOUNG RD
MORRIS RD
SCHISLER RD

mile 1 0 1 2 3 miles
metres 1000 0 1 2 3 4 kilometres

Major Features Phase 4A

Siting Option LF-1E/PI-27E

MAP 6

Final report

OWMC
Ontario
Waste Management
Corporation

A provincial crown corporation.

DILLON

SITE SELECTION PROCESS
PHASE 4A: SELECTION OF A PREFERRED SITE(S)
SITE SELECTION
VOLUME 2 - TECHNICAL APPENDICES - PART 1

June, 1986

This document consists of the Technical Appendices which accompany Chapters 1-4 of Volume 2 of Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Site Selection.

Chapters 1-4 are bound as Part 1 of Volume 2.

DILLON
Consulting Engineers & Planners

OUR FILE: 1106-21-2
YOUR FILE:

26 June 1986

Dr. B.D. Mitchell
Director of Corporate Planning
and Development
Ontario Waste Management Corporation
11th Floor, 2 Bloor Street West
Toronto, Ontario
M4W 3W2

Attention: Mr. J.G. Micak,
Manager, Environmental Projects

Site Selection Process
Phase 4A: Selection of a Preferred Site(s) -
Site Selection - Volume 2

Dear Sirs:

We are pleased to submit the Technical Appendices to Volume 2 of our two-volume report - Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Site Selection. The report provides the technical documentation of the activities undertaken by a team of site selection consultants in the comparison of eight candidate sites. It also addresses the major reasons for the Phase 4A interpretations and conclusions reached by the site selection team and by the site selection coordinating consultant, M.M. Dillon Limited.

This volume presents a series of technical appendices intended to accompany Volume 2. The appendices are organized according to the chapters in Volume 2. Introductions are provided, where necessary, so that the reader understands the purpose and scope of the appendix.

Yours truly,
M.M. DILLON LIMITED

David P. Lawrence, M.C.I.P.
Site Selection Manager

DPL:ch
Encl.

M. M. DILLON LIMITED – 47 SHEPPARD AVENUE EAST, TORONTO, ONTARIO • (416) 229-4646
MAIL: BOX 1850, STATION A, WILLOWDALE, ONTARIO, CANADA M2N 6H5 • TELEX 064-7540

SITE SELECTION PROCESS

PHASE 4A: SELECTION OF A PREFERRED SITE(S)

Volume 2 - Technical Appendices - Part 1

Volume 2 Chapter	Appendix
1.0 Introduction	-
2.0 Existing Environment	A
3.0 Design Modifications	-
4.0 Factor Identification, Refinement and Ranking	B

APPENDIX A

(Appendix to Chapter 3)

APPENDIX A

INTRODUCTION

Appendix A consists of the following tables:

- Table A.1 - Data Matrix - LF-4N/PI-1N and LF-4N/PI-13N
- Table A.2 - Data Matrix - LF-9C and LF-3C
- Table A.3 - Data Matrix - LF-1E and LF-1E/PI-27E

These data matrices accompany Chapter 2 - Existing Environment. The data describe the existing environment following the refinement of site boundaries (Volume 1, Chapter 4).

TABLE A.1

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-4N/PI-1N		LF-4N/PI-13N	
				LF-4N	PI-1N	LF-4N	PI-13N
	A. RISK						
	• Transportation	• annual province-wide hazard-based spill index of OWMC generated transport	• spill index due to motor vehicle accident involvements	1.967		1.967	
			• spill index due to non-motor vehicle accident events	10.488		10.488	
		• annual province-wide accident involvements of OWMC generated transport	• annual number of vehicles involved in accidents	2.44		2.44	
		• transportation risks on local and regional access roads due to accident involvements of OWMC generated transport	• road user risk due to accident involvements[1]	6.12		5.81	
		• transportation risks on local and regional access roads due to hazard-based spills of OWMC generated transport	• road user risk index associated with hazard-based spill index	12.00		8.78	
			• population risk index associated with hazard-based spill index	1181.7		1004.1	
			• sensitive community and recreation features risk index associated with hazard-based spill index	0		0	
			• surface water suitability risk index	3		3	
			• hydrogeologic sensitive land risk index associated with hazard-based spill index	0.164		0.036	
	• Air Quality	• risk from direct inhalation of emissions - chronic	• relative population exposure - incinerator stack emissions	- n/applicable	- 1606 (Index)	- n/applicable	- 3281 (Index)
			• relative population exposure - fugitive emissions	- 1787 (Index)	- 1507 (Index)	- 1787 (Index)	- 1061 (Index)

Note: [1] Values for road user indices divided by 1000

TABLE A.1

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-4N/PI-1N		LF-4N/PI-13N	
				LF-4N	PI-1N	LF-4N	PI-13N
	A. RISK (continued)						
	• Air Quality		• relative future population exposure - incinerator stack emissions	- n/applicable	- 4278 (Index	- n/applicable	- 5797 (Index)
			• relative future population exposure - fugitive emissions	- 2577 (Index)	- 2884 (Index)	- 2577 (Index)	- 3169 (Index)
		• risk from direct inhalation of emissions - acute	• topographic feature on or around site	- relatively flat, land gently sloping up towards escarpment	- site relatively flat, Sixteen Mile Creek running east-west, north of site in a depression approximately 20 m	- relatively flat, land gently sloping up towards escarpment	- site relatively flat, Sixteen Mile Creek is in a depression of approximately 25 m, .8 to 2 km from site to east and south
			• relative population exposure - upset emissions from incinerator stack	- n/applicable	- 4552 (Index)	- n/applicable	- 1620 (Index)
			• relative population exposure - upset emissions from low elevation sources	- 126 (Index)	- 184 (Index)	- 126 (Index)	- 277 (Index)
			• relative future population exposure - upset emissions from incinerator stack	- n/applicable	- 5875 (Index)	- n/applicable	- 3658 (Index)
			• relative future population exposure - upset emissions from low elevation sources	- 137 (Index)	- 208 (Index)	- 137 (Index)	- 320 (Index)
			• distribution of community facilities (# of facilities)	- 8	- 8	- 8	- 2
		• risks from ingestion of cistern and pond water	• relative exposure from cistern and pond water - incinerator stack emissions	- n/applicable	- 0.19 (Index)	- n/applicable	- 0.19 (Index)
			• relative exposure from cistern and pond water - fugitive emissions	- 61.8 (Index)	- 48.3 (Index)	- 61.8 (Index)	- 93.1 (Index)
		• risks from consumption of crops and livestock	• relative sensitive crop exposure - incinerator stack emissions	- n/applicable	- 1364401 (Index)	- n/applicable	- 1252402 (Index)
			• relative sensitive crop exposure - fugitive emissions	- 19790392 (Index)	- 15864400 (Index)	- 19790392 (Index)	- 18161846 (Index)
			• relative sensitive livestock exposure - incinerator stack emissions	- n/applicable	- 103084 (Index)	- n/applicable	- 86226 (Index)

TABLE A.1

Phase 4A - Detailed Comparative Evaluation
Comparative Evaluation of Siting Options
Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-4N/PI-1N LF-4N	LF-4N/PI-1N PI-1N	LF-4N/PI-13N LF-4N	LF-4N/PI-13N PI-13N
	A. RISK (concluded)						
	• Air Quality		• relative sensitive livestock exposure - fugitive emissions	- 1407213 (Index)	- 1118742 (Index)	- 1407213 (Index)	- 1914902 (Index)
			• relative future sensitive crop exposure - incinerator stack emissions	- n/applicable	- 1360077 (Index)	- n/applicable	- 1252402 (Index)
			• relative future sensitive crop exposure - fugitive emissions	- 19768672 (Index)	- 15791588 (Index)	- 19790392 (Index)	- 18161846 (Index)
			• relative future sensitive livestock exposure - incinerator stack emissions	- n/applicable	- 103084 (Index)	- n/applicable	- 86226 (Index)
			• relative future sensitive livestock exposure - fugitive emissions	- 1407213 (Index)	- 1118742 (Index)	- 1407213 (Index)	- 1914902 (Index)
	• Hydrogeologic Suitability	• capability to provide natural containment	• predictability of geologic condition	- uniform	- uniform	- uniform	- locally variable
			• contaminant breakthrough time	- short	- short	- short	- short
		• ground water use	• availability of alternative ground water supplies	- yes	- yes	- yes	- no
			• existing ground water use and potential demand	- potential for expansion	- limited	- potential for expansion	- limited
	• Surface Water Suitability	• susceptibility of site to flooding	• designated floodplains and floodprone areas	- small areas in the southwest and northwest corners of the site are designated floodplain land	- minor floodprone area along swale on east side of site which outlets beneath Highway 25; none of site designated floodplain lands	- small areas in the southwest and northwest corners of the site are designated floodplain land	- minor floodprone areas on southeast and southwest corners of site; none of site designated floodplain lands
			• conveyance capacity	- upstream drainage area is approximately 0 ha	- upstream drainage area is approximately 570 ha	- upstream drainage area is approximately 0 ha	- upstream drainage area is approximately 56 ha
			• run-off potential	- outlet swales just have sufficient slope for conveying runoff off-site; capacity constraints associated with LF-4N	- outlet swales generally have adequate slope and downstream capacity	- outlet swales just have sufficient slope for conveying runoff off-site; conveyance capacity constraints associated with LF-4N	- flooding of site due to insufficient downstream swale capacity not likely
		• potential for surface water use interference	• downstream water use index	36		40	
			• number of local stream takings for potable supply	0		2	

TABLE A.1
Phase 4A - Detailed Comparative Evaluation
Comparative Evaluation of Siting Options
Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-4N/PI-1N		LF-4N/PI-13N	
				LF-4N	PI-1N	LF-4N	PI-13N
SITE	B. ENVIRONMENTAL IMPACTS						
	• Residents	• displacement of residents	• number of residents displaced	54		31	
			• characteristics of residents displaced				
			- number over 65 yrs. of age	2		1	
			- number full-time farm households	0		2	
			- % of dwellings owned	90%		62%	
			- number of residents 5-13 yrs. of age	5		6	
			- # of housewives	1		1	
			• attachment to place				
			- number of households at current address more than 20 years	3		2	
			- number of households in municipality more than 20 years	3		3	
			- number of households with ancestors who owned property	3		3	
			- number of households with ancestors who lived in municipality	2		2	
			- number of friends in area	11		14	
			- number of relatives in area	1		7	
	• Businesses	• displacement of businesses	• number and characteristics of businesses displaced:				
			- number of businesses	5		3	
			- number of employees	14		8	
			- annual sales ($'000)	709		269	
	• Community Features and Services	• displacement of historical, community and recreation features	• number of features displaced	2		2	
			• number of significant features displaced	2		1	
	• Community and Regional	• archaeological resources	• number of significant archaeological resources impacted	3		1	

TABLE A.1
Phase 4A - Detailed Comparative Evaluation
Comparative Evaluation of Siting Options
Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-4N/PI-1N		LF-4N/PI-13N	
				LF-4N	PI-1N	LF-4N	PI-13N
SITE (cont'd)	B. ENVIRONMENTAL IMPACTS						
	° Land Use	° existing land uses	° existing land use pattern	- 100% rural/vacant	- 93% rural/vacant, 7% other	- 100% rural/vacant	- 100% rural/vacant
			° number of residences	11		10	
			° industrial and commercial facilities	0		0	
		° proposed and planned land uses	° land use designations	- 34% agriculture, 4% conservation and hazard lands, 62% sanitary landfill	- 78% agriculture, 22% conservation and hazard lands	- 34% agriculture, 4% conservation and hazard lands, 62% landfill	- 95% agriculture, 5% conservation and hazard lands
			° approved development proposals	none		none	
			° unapproved development proposals	none		none	
			° vacant lots of record	9		3	
			° local Official Plan policies	- prime agricultural designation with sanitary landfill permitted; - protective policies for farmland; - sanitary landfill excludes industrial and hazardous wastes - OPA required	- prime agricultural designation - protective policies for farmlands - OPA required	- prime agricultural designation with sanitary landfill permitted-protective policies for farmland; - sanitary landfill excludes industrial and hazardous wastes - OPA required	- prime agricultural designation - protective policies for farmlands - OPA required
			° regional Official Plan policy	- rural designation - strongly protective policies for prime farmlands - OPA may not be required - no policies for liquid waste treatment or disposal	- rural designation - strongly protective policies for farmland; - OPA may not be required	- rural designation - strongly protective policies for prime farmlands - OPA may not be required - no policies for liquid waste treatment or disposal	- rural designation-strongly protective policies for farmlands - OPA may not be required
			° local zoning by-laws	- 34% agricultural, 16% conservation, 62% sanitary landfill	- 100% agricultural	- 34% agricultural, 4% conservation, 62% sanitary landfill	- 100% agricultural
		° land use stability	° land sales	0		0	
			° development proposals	see above		see above	
			° absentee land ownership - area - properties	 66% 53%		 86% 54%	
			° building quality - good - fair - poor	 82% 18% 0%		 67% 33% 0%	
			° trends in land values	none		none	

TABLE A.1

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-4N/PI-1N		LF-4N/PI-13N	
				LF-4N	PI-1N	LF-4N	PI-13N
SITE (cont'd)	B. **ENVIRONMENTAL IMPACTS**						
	• **Agricultural Resources**	• displacement of farms with on-site headquarters	• number of farm operations owned	2		2	
			• number of farm operations rented	0		2	
			• average farm size owned (ha)	12		12	
			• average farm size rented (ha)	0		101	
			• gross farm revenue ($000s)	77.0		177.3	
		• loss of farmland	• soil capability (Class 1 equivalent) (ha)	264		261	
			• tile drainage (ha)	0		0	
	• **Natural Environment**	• rare species	• number of rare plant species	- 13 species	- 2 species	- 13	- 1
				1 on both		1 on both	
			• number of rare animal species	- 0	- 0	- 0	- 3
		• natural vegetation displaced	• number of hectares of natural vegetation displaced	67 ha		59 ha	
		• potential for occurrence of other significant features	• level of potential for occurrence of significant features	low potential		low potential	

TABLE A.1
Phase 4A - Detailed Comparative Evaluation
Comparative Evaluation of Siting Options
Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-4N/PI-1N		LF-4N/PI-13N	
				LF-4N	PI-1N	LF-4N	PI-13N
SITE VICINITY	B. ENVIRONMENTAL IMPACTS						
	° Residents	° property value impacts	° potential for negative change in property values within 1500 m zone ($'000)	1,487		1,912	
		° disruption of use and enjoyment of property and/or day-to-day activities (adjacent to site)	° # of residents adjacent to site and spending most time on property	23		28	
			° # of residents adjacent to site	88		95	
		° disruption of use and enjoyment of property and/or day-to-day activities (non-adjacent)	° # of residents spending most time on properties within 55 dBA noise impact zone	9		9	
			° # of residents within noise impact zone				
			- 50 dBA	15		6	
			- 55 dBA	55		55	
			° visual intrusion				
			- number of households within foreground	43		54	
			- number of households within middleground	131		123	
			° # of residents within site vicinity	759		959	
	° Businesses	° business activities that are negatively affected by the presence of OWMC facilities	° number	14		16	
			° employment	39		91	
			° annual sales ($000)	1,475		4,318	
		° business activities that are positively affected by the presence of OWMC facilities	° number	1		2	
			° employment	125		129	
			° annual sales ($000)	7,500		7,568	

TABLE A.1
Phase 4A - Detailed Comparative Evaluation
Comparative Evaluation of Siting Options
Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-4N/PI-1N		LF-4N/PI-13N	
				LF-4N	PI-1N	LF-4N	PI-13N
SITE VICINITY (cont'd)	B. ENVIRONMENTAL IMPACTS						
	• Community Facilities and Services	• disruption of operations of community and recreation features (adjacent to site)	• # of sensitive features adjacent to site	0		0	
			• # of features adjacent to site	1		2	
		• disruption of operations of community and recreation features (site vicinity)	• # of sensitive features within noise impact zone	0		0	
			• # of features within noise impact zone	1		1	
			• # of sensitive features within site vicinity	6		7	
			• # of features within site vicinity	16		16	
	• Land Use	• existing land use	• existing land use pattern	- other - 2%; residential cluster - 4%; rural/vacant - 94%		- other 1%; res. cluster - 4%; rural/vacant - 95%	- other - 3%; commercial - 1%; res. cluster - 1%; rural/vacant - 95%
			• # of residences	220		302	
			• # of residences within 1000 m	64		85	
			• # of residences/1000 ha (residences/1000 ha)	56		62	
			• industrial and commercial facilities				
			- commercial	12		20	
			- industrial	2		1	
		• proposed and planned land use	• land use designations	- agriculture - 55% ; conservation & hazard lands - 10%; Niagara Escarpment - 14%; Parkway Belt - 21%		- agriculture - 64%; Niagara Escarpment Plan - 24%; conservation & hazard lands - 12%	- residential - 1%; agricultural - 55%; Parkway Belt - 24% conservation and hazard lands - 20%
			• approved development proposals	- residential (2 units, 40.47 ha)	- none	- residential (2 units, 40.47 ha)	- none
			• unapproved development proposals	- none	- none	- none	- none
			• vacant lots of record	66		69	

TABLE A.1

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-4N/PI-1N		LF-4N/PI-13N	
				LF-4N	PI-1N	LF-4N	PI-13N
SITE VICINITY (cont'd)	B. ENVIRONMENTAL IMPACTS						
		° proposed and planned land use	° local Official Plan policies	- prime agricultural designation - protective policies for farmlands significant rural residential cluster (Royne) - no significant development policies		- prime agricultural designation - protective policies for farmlands - significant rural residential cluster (Boyne)- no significant development policies	- prime agricultural designation - protective policies for farmlands - small rural residential clusters (Omagh, Drumquin); no significant development policies
			° regional Official Plan policies	- rural designation (strongly protective policies for prime agricultural lands) - no urban land or development policies		- rural designation (strongly protective policies for prime agricultural lands) - no urban lands or development policies	- rural designation (strongly protective policies for prime agricultural lands) - no urban lands or development policies - adjacent to environmentally sensitive area - environmental assessment required
			° local zoning by-laws	- Medium Industry (M2) 2.1%; Light Industry (M1) 1.2%; Heavy Industry (M3) 1.2%; Agriculture (A) 45.8%; Conservation (O) 49.7%	- Conservation (O4) 3.1%; Semi-Public O.S. (O3) 2.5%; Public OS (O1) 0.2%; Conservation (O) 7.6%; Agriculture (A) 86.6%	- Medium Industry (M2) 2.1%; Light Industry (M1) 1.2%; Heavy Industry (M3) 1.2%; Agriculture (A) 45.9%; Conservation (O) 49.7%	- Conservation (O4) 3.4%; Semi-Public O.S. (O3) 2.8%; Public O.S. (O1) 0.2%; Conservation (O) 8.4%; Agriculture (A) 85.19% Rural Commercial (C.4) 0.01%
		° provincial policies and plans	° Niagara Escarpment Plan	- moderate - includes Escarpment protection and complementary use areas	- moderate - includes Escarpment protection and complementary use areas	- moderate - includes Escarpment protection and complementary use areas	- not affected
			° Parkway Belt West Plan	- moderate - public and open space uses	- moderate public and open space uses	- moderate public and open space uses	- low - public and open space, and transportation and utility uses
		° land use stability	° land sales (1983-84)	15		21	
			° development proposals	- see above	- see above	see above	
			° absentee land ownership				
			- area	76%		80%	
			- properties	26%		29%	
			° building quality				
			- good	89%		86%	
			- fair	7%		11%	
			- poor	4%		3%	
			° trends in land value	- Milton area farmland sale values rose sharply 1980-81, declined sharply 1981-82 - overall decrease of 4% 1980-83		- Milton area farmlands sales values rose sharply in 1980-81, declined sharply 1981-82 - overall decrease of 4% 1980-83	

TABLE A.1

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-4N/PI-1N		LF-4N/PI-13N	
				LF-4N	PI-1N	LF-4N	PI-13N
SITE VICINITY (cont'd)	B. ENVIRONMENTAL IMPACTS						
	• Agricultural Resources	• partial displacement of farms (off-site farms with on-site land)	• # of farms with headquarters	5		1	
			• average parcel size (ha)	50		79	
			• proportion of land base lost (%)				
			- owned	0%		0%	
			- rented	15%		15%	
		• disruption of adjacent farm operations	• # of farms with headquarters	5		8	
			• # of operators with owned land	8		11	
			• livestock density (animal units/ha)	0.40		0.54	
		• disruption of non-adjacent vicinity operations	• # of farms with headquarters	16		19	
			• proportion of non-adjacent vicinity in crops (%)	67%		66%	
			• livestock density (animal units per ha)	0.45		0.28	
	• Natural Environment	• significant environmental units (SEU)	• areal extent of SEU	140 ha		94 ha	
		• fish and wildlife features of significance	• number of significant features	- 1 feature, waterfowl staging area		- 1 feature, waterfowl staging area	
		• other natural vegetation	• areal extent	245 ha		291 ha	
		• rare species	• number of rare plant species	8		7	
			• number of rare animal species	3		6	
	• Air Dispersions/ Air Quality	• restraints to dispersion	• local modifications to dispersion climatology	- wind channelling and increased levels of turbulence are possible	- wind channelling and increased levels of turbulence are possible	- wind channelling and increased levels of turbulence are possible	- wind channelling possible, less than PI-1N or LF-4N
			• existing air quality[1]	- 0.5 (Index)	- 0.6 (Index)	- 0.5 (Index)	- 0.7 (Index)

Note: [1] Index describes the relationship between the existing annual averaged levels of SO_2, NO_x, TSP, THC and the ambient air quality

TABLE A.1

Phase 4A - Detailed Comparative Evaluation
Comparative Evaluation of Siting Options
Data Matrix - Total Solidification

					LF-4N/PI-1N		LF-4N/PI-13N	
STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS		LF-4N	PI-1N	LF-4N	PI-13N
SITE VICINITY (Concluded)	B. ENVIRONMENTAL IMPACTS							
	° Air Dispersion/ Air Quality	° existing and anticipated air quality	° existing short-term air quality[2]	- SO_2	0	- 0	0	- 0
				- NO_x	0	- 0	0	- 0
				- TSP	0	- 0	0	- 0
				- THC	0	- 0	0	- 0
			° estimated effect on air quality - incinerator stack emissions[3]	- SO_2	N/A	1.00	N/A	1.00
				- NO_x	N/A	1.01	N/A	1.01
				- TSP	N/A	1.00	N/A	1.00
				- THC	N/A	1.00	N/A	1.00
			° estimated effect on air quality - fugitive emissions[4]		- 1.06	- 1.06	1.06	1.06

Note: [2] Maximum short-term (½ hr) ambient air concentrations (pollutant loading index)

[3] Projected maximum annual increments of SO_2, NO_x, TSP and THC concentrations due to incinerator emissions

Index = $\dfrac{\text{Concentration attributed to facility plus existing concentration}}{\text{existing concentration}}$

[4] Projected maximum annual increments of TSP and THC due to fugitive emissions

Index = $\dfrac{\text{Concentration attributed to facility plus existing concentration}}{\text{existing concentration}}$

TABLE A.1
Phase 4A - Detailed Comparative Evaluation
Comparative Evaluation of Siting Options
Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-4N/PI-1N		LF-4N/PI-13N	
				LF-4N	PI-1N	LF-4N	PI-13N
COMMUNITY AND REGIONAL	B. ENVIRONMENTAL IMPACTS						
	• Community and Regional	• municipal finance	• net financial impact on area municipality ($'000)	35.2		34.9	
			• net financial impact on regional municipality ($'000)	-32.7		-43.0	
			• net financial impact on area municipality tax rate (%)	1.0		1.0	
			• stability index	221		214	
		• social stability	• municipal growth 1971 - 1981	500%		300%	
			• disruption through resident displacement (on-site residents) - % of displaced households at current address more than 5 years	67%		63%	
			- % of displaced that are homeowners	89%		62%	
			- % of displaced households whose ancestors owned property	33%		38%	
			- % of displaced households whose ancestors lived in municipality	22%		25%	
			• disruption through out-migration (adjacent and vicinity residents) - % of moving households that are homeowners	100%		100%	
			- % of moving households living at current address more than 5 years	31%		53%	
			- % of moving households whose ancestors owned property	31%		35%	
			- % of moving households whose ancestors lived in municipality	31%		35%	

TABLE A.1

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

				LF-4N/PI-1N		LF-4N/PI-13N	
STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-4N	PI-1N	LF-4N	PI-13N
COMMUNITY AND REGIONAL (cont'd)	B. ENVIRONMENTAL IMPACTS	° social cohesion	° disruption through resident displacement:				
			- # of friends and relatives of those displaced	12		21	
			- # of displaced households with community group leaders	1		4	
			- # of displaced households with community group members	5		6	
			- # of displaced households with children	3		5	
			- # of children in displaced households	4		7	
			° disruption through out-migration:				
			- # of moving households with community group leaders	1		3	
			- # of moving households with community group members	5		8	
			- # of moving households with children	8		7	
			- # of children in moving households	12		9	
			° # of community features contributing to cohesion disrupted	0		0	
		° community character/image	° compatibility with existing land uses:				
			- existing non-industrial land use as a % of existing land use within 2 km.	100%		100%	
			- existing non-industrial land use as a % of existing land use within 5 km.	100%		100%	
			- designated non-industrial land use as a % of designated land use within 2 km.	100%		100%	

TABLE A.1

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-4N/PI-1N		LF-4N/PI-13N	
				LF-4N	PI-1N	LF-4N	PI-13N
COMMUNITY AND REGIONAL (cont'd)	B. ENVIRONMENTAL IMPACTS		- designated non-industrial land use as a % of designated land use within 5 km.	99%		99%	
			• heritage features:				
			- average heritage value	29.6		28.8	
			- density of structures	1.8		2.0	
			- historic landscape (rank)[1]	2.0		2.0	
			• visual compatibility:				
			- with respect to land use (rank)[2]	5		6	
			- intrusion on passing traffic (rank)[2]	5		6	
		• regional and community economic base	• new regional jobs created	331		331	
			• additional households: - region - area municipality	 172 77		 172 77	
			• perceived impact on community economy:				
			- business perceiving positive impacts	6		7	
			- business perceiving negative impacts	20		21	
		• tourism economy	• decline in tourist visitation and attendance	some decline in visitation is possible, but impossible for quantify or to predict with any certainty		some decline in visitation in possible, but impossible to quantify or to predict with any certainty	
			• impact on tourism-related development plans	no evidence to suggest an impact		no evidence to suggest an impact	
			• future development potential	if media attention regarding Milton during the public hearings is derogatory, plans for developing Milton/Halton's image as a tourist destination may be jeopardized		if media attention regarding Milton during the public hearings is derogatory, plans for developing Milton/Halton's image as a tourist destination may be jeopardized	

Note: [1] rank 1.0 = facility inappropriate with existing trends in historic land use
rank 2.0 = facility inconsistent with existing trends in historic land use
rank 3.0 = facility consistent with existing trends in historic land use
[2] rank 1.0 = least impacted

TABLE A.1

Phase 4A - Detailed Comparative Evaluation
Comparative Evaluation of Siting Options
Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-4N/PI-1N		LF-4N/PI-13N	
				LF-4N	PI-1N	LF-4N	PI-13N
COMMUNITY AND REGIONAL (cont'd)	B. ENVIRONMENTAL IMPACTS						
		° tourism operations	° reduction in tourism visitation/occupancy rates	- no evidence of an impact	- no evidence of an impact	- no evidence of an impact	- no evidence of an impact
			° presence of nuisance impacts	- no evidence of an impact	- no evidence of an impact	- no evidence of an impact	- no evidence of an impact
			° impacts related to tourism - related special views	- scenic views from Mt. Nemo, Rattlesnake Point and Vistas along the Niagara Escarpment would be affected	- scenic views from Mt. Nemo, Rattlesnake Point and Vistas along the Niagara Escarpment would be minimally altered by the presence of OWMC facilities	- scenic views from Mt. Nemo, Rattlesnake Point and Vistas along the Niagara Escarpment would be affected	- scenic views from Mt. Nemo, Rattlesnake Point and Vistas along the Niagara Escarpment would not be significantly affected
			° visual exposure of passing tourist traffic to site	- while OWMC facilities could be considered as incompatible with no surrounding land uses, the impact should be minor	- while OWMC facilities could be considered as incompatible with no surrounding land uses, the impact should be minor	- while OWMC facilities could be considered incompatible with no surrounding land uses, the impact should be minor	- while OWMC facilities could be considered incompatible with no surrounding land uses, the impact should be minor
	° Land Use	° existing land use	° existing land use pattern	2% residential; 2% residential cluster 96% rural/vacant		2% residential; 1% residential cluster; 97% rural/vacant	
		° proposed and planned land use	° land use designations	4% residential; 1% Ind.; 42% agricultural; 5% rural; 15% conservation and hazard/land; 33% Parkway Belt; (23% Niagara Escarpment Planning Area, if superimposed)		2% residential; 1% industrial; 3% rural/vacant; 50% agricultural;15% conservation and hazard lands; 29% Parkway Belt; (33% Niagara Escarpment Planning Area, if superimposed)	
			° local Official Plan policies	- significant urban residential designation in Milton (estimated population capacity 6,000); - rural cluster - Omagh and Boyne,includes part of Lowville Settlement area; - substantial prime agricultural lands, protective policies for farmlands		- significant urban residential designation in Milton; (estimated population capacity 6,000); - rural cluster in Boyne; part of Lowville Settlement area; - substantial prime agricultural lands - protective policies for farmland	- small rural residential cluster at Boyne; - prime agricultural designation - protective policies for farmland - no urban areas
			° regional Official Plan policies	- significant urban residential designation in Milton and Hamlet of Lowville; - substantial prime agricultural lands - protective policies farmlands		- significant residential designation in Milton urban area and Hamlet of Lowville; - substantial prime agricultural lands, protective policies for farmlands	- substantial prime agricultural designation policies for farmlands; - no urban areas

TABLE A.1

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-4N/PI-1N		LF-4N/PI-13N	
				LF-4N	PI-1N	LF-4N	PI-13N
COMMUNITY AND REGIONAL (cont'd)	B. ENVIRONMENTAL IMPACTS						
		° provincial policies and plans	° Niagara Escarpment Plan	- escarpment protection area - escarpment rural area - minor urban centre (Lowville)	- escarpment protection area - escarpment rural area	- escarpment protection area - escarpment rural area - minor urban centre (Lowville)	- not affected
			° Parkway Belt West Plan	public and open spaces uses		- public and open space uses	- possible Res. OPA - public and open space uses
	° Agricultural Resources	° stability of farm population	° % of operators under 55 years of age	62%		58%	
			° full-time operators (% of total operators)	56%		49%	
		° stability of land base	° tenure				
			- large parcels (% of land in parcels over 12.6 ha)	82%		81%	
			- owned farmland (% of total)	32%		27%	
			- area farmed (% of total)	89%		87%	
			° farm residences as % of total residences	34%		28%	
			° agriculturally designated land (Class 1 equiv.)	87%		84%	
			° private land ownership (% of total)	100%		88%	
		° disruption to the farm economy	° gross farm revenue ($M, 1981)	6.4		16.3	
			° relative exposure to fugitive emissions				
			- livestock index (M)	1.19		3.94	
			- crop index (M)	0.21		0.47	
			° relative exposure to stack emissions				
			- livestock index (M)	0.12		0.12	
			- crop index (M)	0.04		0.04	
			° downstream livestock	2		1	

TABLE A.1

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-4N/PI-1N LF-4N QEM	 401	 Between Sites	 PI-1N QEM	 401	LF-4N/PI-13N LF-4N QEM	 401	 Between Sites	 PI-13N QEM	 401
ACCESS ROADS	B. ENVIRONMENTAL IMPACTS												
	• Residents	• disruption of day-to-day activities and/or the use and enjoyment of property (adjacent)	• characteristics of residents										
			- # 0-5 years age			39					24		
			- # 6-15 years of age			74					67		
			- # over 65 years of age			26					29		
			• number of residents adjacent to access roads			435					481		
		• disruption of day-to-day activities and/or the use and enjoyment of property (vicinity)	• number of residents within noise impact zone			358					370		
			• number of residents within access road vicinity			295					347		
	• Community Features and Services	• disruption of operations of community and recreation features (adjacent)	• number of sensitive features adjacent to access road			7					7		
			• number of features adjacent to access road			16					16		
		• disruption of operations of community and recreation features (vicinity)	• number of sensitive features within noise impact zone			14					14		
			• number of features within noise impact zone			20					20		
			• number of sensitive features within access road vicinity			5					7		
			• number of features within access road vicinity			12					15		
	• Land Use	• existing land uses	• existing land use pattern										
			- rural/vacant	76%	94%	100%	67%	93%	76%	94%	96%	77%	92%
			- residential cluster	10%	3%		14%	3%	10%	3%	4%	11%	4%
			- other	14%	3%		19%	4%	14%	3%		12%	4%
			• number of residences	178	70	9	151	63	178	70	63	209	54
			• industrial facilities	1	0	0	0	1	1	0	0	1	0
			• commercial facilities	16	3	1	15	2	16	3	3	16	0

TABLE A.1
Phase 4A - Detailed Comparative Evaluation
Comparative Evaluation of Siting Options
Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-4N/PI-1N					LF-4N/PI-13N				
				LF-4N			PI-1N		LF-4N			PI-13N	
				QEW	401	Between Sites	QEW	401	QEW	401	Between Sites	QEW	401
ACCESS ROADS (cont'd)	B. ENVIRONMENTAL IMPACTS												
	° Land Use	° planned and proposed land uses	° land use designations										
			- residential	11%			14%		11%			10%	
			- rural residential cluster		2%			2%		2%	2%		2%
			- Parkway Belt	56%	56%		45%	72%	56%	56%	39%	47%	65%
			- agricultural	52%	20%	80%	22%	6%	52%	20%	42%	25%	14%
			- open space/hazard	8%	22%	12%	1%	20%	8%	22%	17%	7%	19%
			- other	13%			18%		13%			11%	
			° approved development proposals	none	none	none	none	none	none	none	none	none	none
			° unapproved development proposals	none	1 residential/ commercial/ industrial mix 404.7 ha	none	none	1 residential/ commercial/ industrial mix 404.7 ha	none	1 residential commercial industrial mix 404.7 ha	none	none	1 residential commercial industrial mix 404.7 ha
			° vacant lots of record	57	19	9	38	7	57	19	14	43	3
			° local Official Plan policies	- urban residential designated south of Hwy 5 - rural cluster at Boyne - special study area at Palermo	- rural clusters at Boyne & Omagh - O.P. provides for possible future urban residential uses at NW corner of Fourth Line and Derry Rd.	- agricultural route	- urban residential designated south of Hwy. 5 - special study area at Palermo	- rural clusters at Boyne & Omagh - O.P. provides for possible future urban residential uses on NW corner of Fourth Line & Derry Rd.	- urban residential designated south of Hwy 5 - rural cluster at Boyne - special study area at Palermo	- rural cluster at Boyne & Omagh - O.P. provides for possible future urban residential uses on NW corner of Fourth Line & Derry Rd.	- rural clusters at Boyne & Omagh	- urban residential south of Hwy. 5 - Palermo study area - rural clusters - Omagh and Boyne	- possible future urban residential on NW corner of Fourth Line & & Derry Rd.; - O.P.A. required - rural cluster - Omagh

TABLE A.1

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-4N/PI-1N					LF-4N/PI-13N				
				LF-4N			PI-1N		LF-4N			PI-13N	
				QEW	401	Between Sites	QEW	401	QEW	401	Between Sites	QEW	401
ACCESS ROADS (cont'd)	B. ENVIRONMENTAL IMPACTS												
	• Land Use		• regional Official Plan policies	- urban area designated south of Hwy. 5	- no hamlets or urban residential	- no hamlets or urban residential designated	- urban area designated south of Hwy. 5	- no hamlet or urban residential designations on access routes	- urban designation south of Hwy. 5	- no hamlets or urban residential	- no hamlets or urban residential designated	- urban designation south of Hwy. 5	- no hamlets or urban residential
	• Agricultural Resources	• distribution to farm traffic and cattle crossings	• local roads										
			- agricultural vehicle impact index ('000)			10.00					12.15		
			- # of customer/service vehicle stops ('000)			9.50					12.05		
			- cattle crossings			10					10		
			• regional roads										
			- agricultural vehicle impact index ('000)			10.60					10.60		
			- number of customer/service vehicle stops ('000)			6.00					9.70		
			- cattle crossings			0					0		
		• distribution to crop and livestock production	• adjacent crops ('000 ha)			2.60					3.54		
			• adjacent livestock ('000 of animal units)			0.89					1.34		
			• downstream livestock			7					5		
	• Natural Environment	• fish communities	• spill pathway index			0.721					0.579		
			• downstream length of regionally significant fishery			146 km					146 km		
			• downstream length of locally significant fishery			180 km					190 km		

TABLE A.1
Phase 4A - Detailed Comparative Evaluation
Comparative Evaluation of Siting Options
Data Matrix - Total Solidification

				LF-4N/PI-1N		LF-4N/PI-13N	
STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-4N	PI-1N	LF-4N	PI-13N
	C. ENGINEERING COST[1]						
	• Cost	• capital cost (1984 CAN. $000's)	• incinerator	56,031		56,031	
			• physical/chemical treatment	46,836		46,836	
			• solidification	11,808		11,808	
			• landfill	5,368		5,368	
			• on-site facilities (common)	55,509		55,509	
			• on-site facilities (site specific)	11,959		11,493	
			• off-site facilities (site specific)	2,871		4,467	
		• operating cost summary (1984 CAN. $000's)	• total estimated cost	190,382		191,512	
			• year 10	42,295		42,536	

Note: [1] Cost figures preliminary and subject to change

TABLE A.2

Phase 4A - Detailed Comparative Evaluation
Comparative Evaluation of Siting Options
Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-9C	LF-3C
A. RISK					
	• Transportation	• annual province-wide hazard-based spill index of OWMC generated transport	• spill index due to motor vehicle accident involvements	3.226	3.226
			• spill index due to non-motor vehicle accident events	10.447	10.447
		• annual province-wide accident involvements of OWMC generated transport	• annual number of vehicles involved in accidents	4.36	4.36
		• transportation risks on local and regional access roads due to accident involvements of OWMC generated transport	• road user risk due to accident involvements[1]	26.86	29.18
		• transportation risks on local and regional access roads due to hazard-based spills of OWMC generated transport	• road user risk index associated with hazard-based spill index	51.29	57.06
			• population risk index associated with hazard-based spill index	11102.3	13512.9
			• sensitive community and recreation features risk index associated with hazard-based spill index	12.25	25.05
			• surface water suitability risk index	4	5
			• hydrogeologic sensitive land risk index associated with hazard-based spill index	1.133	1.133
	• Air Quality	• risk from direct inhalation of emissions - chronic	• relative population exposure - incinerator stack emissions	610 (Index)	319 (Index)
			• relative population exposure - fugitive emissions	470 (Index)	433 (Index)
			• relative future population exposure - incinerator stack emissions	610 (Index)	323 (Index)
			• relative future population exposure - fugitive emissions	956 (Index)	794 (Index)

Note: [1] Values for road user indices divided by 1,000

TABLE A.2

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-9C	LF-3C
	A. RISK (Continued)				
	° Air Quality	° risk from direct inhalation of emissions - acute	° topographic feature on or around site	very flat	very flat - river running approximately 2 km south of site in a slight depression (approximately 5 m)
			° relative population exposure - upset emissions from incinerator stack	1547 (Index)	1489 (Index)
			° relative population exposure - upset emissions from low elevation sources	185 (Index)	180 (Index)
			° relative future population exposure - upset emissions from incinerator stack	2186 (Index)	1904 (Index)
			° relative future population exposure - upset emissions from low elevation sources	192 (Index)	187 (Index)
			° distribution of community facilities (# of facilities)	3	2
		° risks from ingestion of cistern and pond water	° relative exposure from cistern and pond waters - incinerator stack emissions	0.27 (Index)	0.45 (Index)
			° relative exposure from cistern and pond waters - fugitive emissions	41.2 (Index)	52.8 (Index)
		° risks from consumption of crops and livestock	° relative sensitive crop exposure - incinerator stack emissions	2520247 (Index)	2731774 (Index)
			° relative sensitive crop exposure - fugitive emissions	10995418 (Index)	9148723 (Index)
			° relative sensitive livestock exposure - incinerator stack emissions	437786 (Index)	540424 (Index)
			° relative sensitive livestock exposure - fugitive emissions	4031442 (Index)	1513674 (Index)
			° relative future sensitive crop exposure - incinerator stack emissions	2518657 (Index)	2729523 (Index)

TABLE A.2

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-9C	LF-3C
	A. RISK (Concluded)				
	• Air Quality		• relative future sensitive crop exposure - fugitive emissions	10979195 (Index)	9129957 (Index)
			• relative future sensitive livestock exposure - incinerator stack emissions	437488 (Index)	540424 (Index)
			• relative future sensitive livestock exposure - fugitive emissions	4027219 (Index)	1513674 (Index)
	• Hydrogeologic Suitability	• capability to provide natural containment	• predictability of geologic condition	uniform	uniform
			• contaminant breakthrough time	long	long
		• ground water use	• availability of alternative ground water supplies	yes	yes
			• existing ground water use and potential demand	potential for expansion	limited
	• Surface Water Suitability	• susceptibility of site to flooding	• designated floodplains and floodprone areas	none of site designated floodplain land; no flood prone areas (on-site) identified; numerous low-lying depressions on-site - easily drained	substantial flood prone area along Beaver Creek; northern portion of site is designated floodplain land (Welland River backwater); small designated floodplain areas (Welland River) along southern boundary of site; uncertainty associated with flood line of Beaver Creek; engineering measures may be required to provide additional level of flood protection
			• conveyance capacity	outlet slopes have adequate slopes but are not well defined; outlet swale capacity is judged inadequate and upgrading recommended	Beaver Creek slope is very mild; backwater conditions from Welland River; upgrading bridge capacity may be necessary
			• run-off potential	total upstream drainage area conveyed through site in approximately 10 ha	total upstream drainage area conveyed through site is approximately 2030 ha
		• potential for surface water use interference	• downstream water use index	36	43
			• number of local stream takings for potable supply	0	0

TABLE A.2

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-9C	LF-3C
SITE	B. ENVIRONMENTAL IMPACTS				
	° Residents	° displacement of residents	° number of residents displaced	9	29
			° characteristics of residents displaced		
			- number over 65 yrs. of age	1	1
			- number full-time farm households	2	0
			- % of dwellings owned	100%	67%
			- number of residents 5-13 yrs. of age	0	7
			- # of housewives	0	1
			° attachment to place		
			- number of households at current address more than 20 yrs.	2	1
			- number of households in municipality more than 20 years	2	3
			- number of households with ancestors who owned property	0	1
			- number of households with ancestors who lived in municipality	0	2
			- number of friends in area	3	5
			- number of relatives in area	1	10
	° Businesses	° displacement of businesses	° number and characteristics of businesses displaced		
			- number of businesses	0	0
			- number of employees	0	0
			- annual sales ($'000)	0	0
	° Community Features and Services	° displacement of historical, community and recreation features	° number of features displaced	0	0
			° number of significant features displaced	0	0

TABLE A.2
Phase 4A - Detailed Comparative Evaluation
Comparative Evaluation of Siting Options
Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-9C	LF-3C
SITE (Cont'd)	B. ENVIRONMENTAL IMPACTS				
	• Community and Regional	• archaeological resources	• number of significant archaeological resources impacted	3	2
	• Land Use	• existing land uses	• existing land use pattern	100% rural/vacant	100% rural/vacant
			• number of residences	3	4
			• industrial and commercial facilities	0	0
		• proposed and planned land uses	• land use designations	95% rural 5% hazard lands	73% rural 27% hazard lands
			• approved development proposals	none	none
			• unapproved development proposals	none	none
			• vacant lots of record	1	1
			• local Official Plan policies	- rural designation - protective policies for prime agricultural lands; waste facilities permitted if impacts minimized; - O.P.A. required as facility will serve beyond township boundary.	- rural designation - protective policies for prime agricultural lands; facilities permitted if impacts minimized; - O.P.A. required as facility will serve beyond township boundary.
			• regional Official Plan policies	- prime agricultural designation - protective policies for farmlands; waste facilities permitted if impacts minimized; - O.P.A. not required.	- prime agricultural designation - protective policies for farmlands; waste facilities permitted if impacts minimized; - O.P.A. not required.
			• local zoning by-laws	100% agricultural	100% agricultural
		• land use stability	• land sales	0	0
			• development proposals	none	none
			• absentee land ownership - area - properties	 30% 25%	 11% 14%
			• building quality - good - fair - poor	 100% 0% 0%	 80% 0% 20%
			• trends in land value	-	-

TABLE A.2
Phase 4A - Detailed Comparative Evaluation
Comparative Evaluation of Siting Options
Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-9C	LF-3C
SITE (Cont'd)	B. ENVIRONMENTAL IMPACTS				
	° Agricultural Resources	° displacement of farms with on-site headquarters	° number of farm operations owned	2	2
			° number of farm operations rented	0	0
			° average farm size owned (ha)	37	65
			° average farm size rented (ha)	0	0
			° gross farm revenue ($000s)	53.0	156.0
		° loss of farmland	° soil capability (Class 1 equivalent)	90	135
			° tile drainage (ha)	19	57
	° Natural Environment	° rare species	° number of rare plant species	6	4
			° number of rare animal species	5	1
		° natural vegetation displaced	° number of hectares of natural vegetation displaced	approximately 61 ha	approximately 73 ha
		° potential for occurrence of other significant features	° level of potential for occurrence of significant features	low potential	moderate to high potential

TABLE A.2

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-9C	LF-3C
SITE VICINITY	B. ENVIRONMENTAL IMPACTS				
	• Residents	• property value impacts	• potential for negative change in property values within 1,500 m zone ($'000)	435	451
		• disruption of use and enjoyment of property and/or day-to-day activities (adjacent to site)	• # of residents adjacent to site and spending most time on property	15	23
			• # of residents adjacent to site	40	48
		• disruption of use and enjoyment of property and/or day-to-day activities (non-adjacent)	• # of residents spending most time on properties within 55 dBA noise impact zone	25	6
			• # of residents within noise impact zone		
			- 50 dBA	9	0
			- 55 dBA	88	34
			• visual intrusion		
			- # of households within foreground	28	16
			- # of households within middleground	48	42
			• # of residents within site vicinity	272	765
	• Businesses	• business activities that are negatively affected by the presence of OWMC facilities	• number	4	9
			• employment	9	69
			• annual sales ($'000)	355	2,348
		• business activities that are positively affected by the presence of OWMC facilities	• number	1	0
			• employment	5	0
			• annual sales ($'000)	65	0

TABLE A.2

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-9C	LF-3C
SITE VICINITY (Cont'd)	B. ENVIRONMENTAL IMPACTS				
	° Community Facilities and Services	° disruption of operations of community and recreation features (adjacent to site)	° # of sensitive features adjacent to site	0	0
			° # of features adjacent to site	0	0
		° disruption of operations of community and recreation features (site vicinity)	° # of sensitive features within noise impact zone	0	2
			° # of features within noise impact zone	0	2
			° # of sensitive features within site vicinity	1	4
			° # of features within site vicinity	2	6
	° Land Use	° existing land use	° existing land use pattern	1% - other 99% - rural/vacant	3% - other 1% - residential 96% - rural/vacant
			° # of residences	75	177
			° # of residences/1,000 ha	59	82
			° # of residences within 1,000	37	30
			° industrial and commercial facilities - commercial - industrial	 7 0	 4 0
		° proposed and planned land use	° land use designations	1% - recreational trailer park 88% - rural 11% - hazard lands	78% - rural 20% - hazard lands 2% - recreational
			° approved development proposals	none	(2) residential (1 unit, 10.0 ha) Robert Land Academy (24.0 ha)
			° unapproved development proposals	none	none
			° vacant lots of record	23	38
			° local Official Plan policies	- rural designation on majority of area (protective policies for prime agricultural land) - small highway commercial property (no significant development policies) - no urban lands	- limited rural residential lands (Hamlet of Oswego) - majority of area designated rural (protective policies for prime agricultural land)

TABLE A.2

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-9C	LF-3C
SITE VICINITY (Cont'd)	B. ENVIRONMENTAL IMPACTS				
	° Land Use	° proposed and planned land use	° regional Official Plan policies	- prime agricultural designation on majority of area (protective policies for farmlands) - no urban lands or development policies	- prime agricultural designation on majority of area (protective policies for farmlands) - no urban lands or development policies
			° local zoning by-laws	0.03% rural commercial (RC-102) 0.04% highway commercial (C3) 1.0% trailer park (T2) 0.03% institutional (1) 98.7% agricultural (A2, A2-124)	0.1% public industrial (M2) 0.05% rural commercial (RC) 1.8% open space (01) 98.05% agricultural (A2, A2-107, A2-132)
		° land use stability	° land sales (1983-84)	9	7
			° development proposals	see above	see above
			° absentee land ownership		
			- area	11%	17%
			- properties	17%	14%
			° building quality		
			- good	69%	68%
			- fair	25%	30%
			- poor	6%	2%
			° trends in land value	- West Lincoln area farmland sales values rose steadily 1980-83 - overall increase of 28% 1980-83	- West Lincoln area farmland sales values rose steadily 1980-83 - overall increase of 28% 1980-83
		° provincial policies and plans	° Niagara Escarpment Plan	not affected	not affected
			° Parkway Belt West Plan	not affected	not affected
	° Agricultural Resources	° partial displacement of farms (off-site farms with on-site land)	° # of farms with headquarters	1	3
			° average parcel size (ha)	20	47
			° proportion of land base lost (%)		
			- owned	16%	18%
			- rented	0%	32%
		° disruption of adjacent farm operations	° # of farms with headquarters	6	5
			° # of operators with owned land	8	10
			° livestock density (animal units/ha)	1.14	0.32
		° disruption of non-adjacent vicinity operations	° # of farms with headquarters	23	32
			° proportion of non-adjacent vicinity in crops (%)	71%	61%

TABLE A.2

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-9C	LF-3C
SITE VICINITY (Concluded)	B. ENVIRONMENTAL IMPACT				
	• Agricultural Resources	• disruption of non-adjacent vicinity operations	• livestock density (animal units per ha)	2.44	1.09
	• Natural Environment	• significant environmental units (SEU)	• areal extent of SEUs	approximately 145 ha	approximately 100 ha
		• fish and wildlife features of significance	• number of significant features	- 2 features - pike spawning areas	- 4 features - 3 pike spawning areas and 1 waterfowl production area
		• other natural vegetation	• areal extent	approximately 111 ha	approximately 298 ha
		• rare species	• number of rare plant species	1	17
			• number of rare animal species	3	3
	• Air Dispersion/ Air Quality	• restraints to dispersion	• local modifications to dispersion climatology	no significant modifications	no significant modifications
		• existing and anticipated air quality	• existing air quality[1]	0.8 (mean index)	0.7 (mean index)
			• existing short-term air quality[2]	- SO_2 Index = 0	Index = 0
				- NO_x Index = 0	Index = 0
				- TSP Index = 0	Index = 0
				- THC Index = 0	Index = 0
			• estimated effect on air quality - incinerator stack emissions[3]	- SO_2 Index = 1.01	Index = 1.01
				- NO_x Index = 1.00	Index = 1.00
				- TSP Index = 1.00	Index = 1.00
				- THC Index = 1.00	Index = 1.00
			• estimated effect on air quality - fugitive emissions[4]	Index = 1.03	Index = 1.03

Notes:

[1] Index describes the relationship between the existing annual levels of SO_2, NO_x, TSP, and THC and ambient air quality

[2] Maximum short-term (½ hour) ambient air concentrations (pollutant loading index)

[3] Projected maximum annual increments of SO_2, NO_x, TSP and THC concentrations due to incinerator emissions

$$\text{Index} = \frac{\text{Concentrations attributed to facility and existing concentration}}{\text{existing concentration}}$$

[4] Projected maximum annual increments of TSP and THC concentrations due to fugitive emissions

$$\text{Index} = \frac{\text{Concentration attributed to facility and existing concentration}}{\text{existing concentration}}$$

TABLE A.2

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-9C	LF-3C
COMMUNITY AND REGIONAL	B. ENVIRONMENTAL IMPACTS				
	° Community and Regional	° municipal finance	° net financial impact on: area municipality ($'000)	164.5	161.4
			° net financial impact on regional municipality ($'000)	196.4	192.1
			° net financial impact on area municipality tax rate ($)	17.6	17.2
		° social stability	° stability index	254	230
			° municipal growth 1971 - 1981	17%	17%
			° disruption through resident displacement (on-site residents)		
			- % of displaced households at current address more than 5 years	100%	67%
			- % of displaced that are homeowners	100%	67%
			- % of displaced households whose ancestors owned property	0%	17%
			- % of displaced households whose ancestors lived in municipality	0%	33%
			° disruption through out-migration (adjacent and vicinity residents)		
			- % of moving households that are homeowners	100%	100%
			- % of moving households living at current address more than 5 years	75%	88%
			- % of moving households whose ancestors owned property	25%	31%

TABLE A.2
Phase 4A - Detailed Comparative Evaluation
Comparative Evaluation of Siting Options
Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-9C	LF-3C
COMMUNITY AND REGIONAL (Cont'd)	B. ENVIRONMENTAL IMPACTS				
		° social stability	- % of moving households whose ancestors lived in municipality	25%	44%
		° social cohesion	° disruption through resident displacement		
			- # of friends and relatives of those displaced	4	15
			- # of displaced households with community group leaders	0	3
			- # of displaced households with community group members	1	9
			- # of displaced households with children	0	3
			- # of children in displaced households	0	9
			° disruption through out-migration		
			- # of moving households with community group leaders	3	7
			- # of moving households with community group members	7	10
			- # of moving households with children	4	11
			- # of children in moving households	8	30
			° # of community features contributing to cohesion disrupted	0	1
		° community character/image	° compatibility with existing land uses		
			- existing non-industrial land use as a % of existing land use within 2 km.	100%	100%
			- existing non-industrial land use as a % of existing land use within 5 km.	100%	100%

TABLE A.2
Phase 4A - Detailed Comparative Evaluation
Comparative Evaluation of Siting Options
Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-9C	LF-3C
COMMUNITY AND REGIONAL (Cont'd)	B. **ENVIRONMENTAL IMPACTS**				
	• **Community and Regional**	• community character/image	- designated non-industrial land use as a % of designated land use within 2 km.	100%	100%
			- designated non-industrial land use as a % of designated land use within 5 km.	100%	100%
			• heritage features		
			- average heritage value	25.5	26.7
			- density of structures	1.7	1.5
			- historic landscape (rank)[1]	5.0	3.0
			• visual compatibility		
			- with respect to land use (rank)[2]	4.0	3.0
			- intrusion on passing traffic (rank)[2]	2.0	1.0
		• regional and community economic base	• new regional jobs created	356	316
			• additional households		
			- region	150	133
			- area municipality	60	67
			• perceived impact on community economy		
			- business perceiving positive impacts	5	5
			- businesses perceiving negative impacts	10	20
		• tourism economy	• decline in tourist visitation and attendance	- no evidence to suggest any decline in visitation levels	- no evidence to suggest any decline in visitation levels

Note: [1] rank 1 = facility inappropriate with existing trends in historic land use
rank 2 = facility inconsistent with existing trends in historic land use
rank 3 = facility consistent with existing trends in historic land use
[2] rank 1 = least impacted

TABLE A.2

Phase 4A - Detailed Comparative Evaluation
Comparative Evaluation of Siting Options
Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-9C	LF-5C
COMMUNITY AND REGIONAL (Cont'd)	B. ENVIRONMENTAL IMPACTS				
	• Community and Regional	• tourism economy	• impact on tourism related development plans	- no evidence to suggest an impact	- no evidence to suggest an impact
			• future development potential	- no evidence of major future tourism development plans; it is possible that a proposed trailer park near LF-9C would be jeopardized from proceeding if LF-9C was selected. Likelihood of the trailer park proceeding at all with or without OWMC facilities is questionable	- no evidence of major future tourism development plans
		• tourism operations	• reduction in tourism visitation/occupancy rates	- no evidence of an impact	- no evidence of an impact
			• presence of resistance impacts	- no evidence of an impact	- no evidence of an impact
			• impacts related to tourism - related special views	- no evidence of an impact	- no evidence of an impact
			• visual exposure of passing tourist traffic to site	- while OWMC facilities could be considered as incompatible with surrounding land uses, the impact should be minor	- while OWMC facilities could be considered as incompatible with surrounding land uses, the impact should be minor
	• Land Use	• existing land use	• existing land use pattern	- 1% residential, 1% residential cluster, 98% rural/vacant	- 1% residential, 99% rural/vacant
		• proposed and planned land use	• land use designations	- 1% hamlet community, 96% rural, 3% hazard lands	- 1% hamlet community, 79% rural, 15% agriculture, 5% hazard lands
			• local Official Plan policies	- rural residential clusters - 4 hamlets - substantial rural designation - protective policies for farmlands - waste facilities permitted if impacts minimized	- rural residential clusters - 5 hamlets - substantial rural designation, protective policies for prime agricultural lands - waste facilities permitted if impacts are minimized
			• regional Official Plan policies	- substantial prime agricultural or rural land - protective policies for farmlands - facilities are permitted if impacts are minimized	- substantial prime agricultural or rural land, - protective policies for farmlands - facilities are permitted if impacts are minimized
		• provincial policies and plans	• Niagara Escarpment Plan	not affected	not affected
			• Parkway Belt West Plan	not affected	not affected
	• Agricultural Resources	• stability of farm population	• % of operators under 55 years of age	75	75
			• full-time operators (% of total operators)	60	52

TABLE A.2

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-9C	LF-3C
COMMUNITY AND REGIONAL (Cont'd)	B. ENVIRONMENTAL IMPACTS				
	° Agricultural Resources	° stability of land base	° tenure		
			- large parcels (% of land in parcels over 12,6 ha)	91%	82%
			- owned farmland (% of total)	76%	74%
			- area farmed (% of total)	94%	91%
			° farm residences as % of total residences	58%	36%
			° agriculturally designated land (Class 1 equiv.)	69%	70%
			° private land ownership (% of total)	100%	98%
		° disruption to the farm economy	° gross farm revenue ($M, 1981)	8,6	6,9
			° relative exposure to fugitive emissions		
			- livestock index (m)	4,41	1,87
			- crop index (m)	0,01	0,01
			° relative exposure to stack emissions		
			- livestock index (m)	0,48	0,63
			- crop index (m)	0,23	0,10
			° downstream index livestock (number)	8	11

TABLE A.2

Phase 4A - Detailed Comparative Evaluation
Comparative Evaluation of Siting Options
Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-9C	LF-3C
ACCESS ROADS	B. ENVIRONMENTAL IMPACTS				
	° Residents	° disruption of day-to-day activities and/or the use and enjoyment of property (adjacent)	° characteristics of residents		
			- # 0-5 years age	78	109
			- # 6-15 years of age	85	119
			- % over 65 years of age	116	129
			° number of residents adjacent to access roads	775	993
		° disruption of day-to-day activities and/or the use and enjoyment of property (vicinity)	° number of residents within noise impact zone	986	1,170
			° number of residents within access road vicinity	1,716	1,794
	° Community Features and Services	° disruption of operations of community and recreation features (adjacent)	° number of sensitive features adjacent to access road	6	9
			° number of features adjacent to access road	14	18
		° disruption of operations of community and recreation features (vicinity)	° number of sensitive features within noise impact zone	7	11
			° number of features within noise impact zone	17	21
			° number of sensitive features within access road vicinity	6	7
			° number of features within access road vicinity	11	13
	° Land use	° existing land uses	° existing land use pattern		
			- residential	6%	4%
			- commercial	0%	0%
			- industrial	1%	1%
			- residential cluster	2%	1%
			- rural/vacant	87%	91%
			- other	4%	3%
			° number of residences	750	833
			° industrial facilities	4	4
			° commercial facilities	51	59

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Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-9C	LF-3C
ACCESS ROADS (Cont'd)	B. ENVIRONMENTAL IMPACTS				
	• Land Use	• planned and proposed land uses	• land use designations		
			- rural - O.S./hazard - residential	79% 20% 9%	81% 16% 3%
			• approved development proposals	1 industrial (1.5 ha) 24 residential - 53 units (58.14 ha)	1 industrial (1.5 ha) 25 residential - 54 units (80.84 ha)
			• unapproved development proposals	1 residential 700 units (19.4 ha)	1 residential 700 units (19.4 ha)
			• vacant lots of record	73	89
			• local Official Plan policies	Vineland - total projected population 8,700	Vineland - total projected population 8,700 Hamlet community of Bismarck
			• regional Official Plan policies	Vineland urban area	Vineland urban area
	• Agricultural Resources	• disruption to farm traffic and cattle crossings	• local roads - agricultural vehicle impact index ('000)	0.00	9.10
			- number of customer/service vehicle stops ('000)	0.00	0.00
			- cattle crossings	0	517
			• adjacent crops ('000 ha)	2.36	3.60
			• adjacent livestock ('000 of animal units)	1.73	7.84
			• downstream livestock	52	48
		• disruption to crop and livestock production	• regional roads - agricultural vehicle impact index ('000)	36.40	85.40
			- number of customer/service vehicle stops ('000)	35.30	36.80
			- cattle crossings	0	0
	• Natural Environment	• fish communities	• spill pathway index	1,521	1,209
			• downstream length of regionally significant fishery	109 km	109 km
			• downstream length of locally significant fishery	27 km	374 km

TABLE A.2

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Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-9C	LF-3C
	C. ENGINEERING COST[1]				
	• Cost	• capital cost (1984 CAN, $000s)	• incinerator	56,031	56,031
			• physical/chemical treatment	46,836	46,836
			• solidification	11,808	11,808
			• landfill	5,866	6,065
			• on-site facilities (common)	55,509	55,509
			• on-site facilities (site specific)	13,664	11,278
			• off-site facilities (site specific)	2,371	2,006
			• total estimated cost	192,085	189,533
		• operating cost summary (1984 CAN, $000s)	• year 10	42,500	42,828

Note: [1] Cost figures preliminary and subject to change

TABLE A.2

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-9C	LF-3C	
	A. RISK					
	° Transportation	° annual province-wide hazard-based spill index of OWMC generated transport	° spill index due to motor vehicle accident involvements	5.43		5.430
			° spill index due to non-motor vehicle accident events	15,582		15,582
		° annual province-wide accident involvements of OWMC generated transport	° annual number of vehicles involved in accidents	6.92		6.92
		° transportation risks on local and regional access roads due to accident involvements of OWMC generated transport	° road user risk due to accident involvements[1]	0.84		0.76
		° transportation risks on local and regional access roads due to hazard-based spills of OWMC generated transport	° road user risk index associated with hazard-based spill index	1.73		1.21
			° population risk index associated with hazard-based spill index	26.6		17.2
			° sensitive community and recreation features risk index associated with hazard-based spill index	0		0
			° surface water suitability risk index	1		1
			° hydrogeologic sensitive land risk index associated with hazard-based spill index	0		0
	° Air Quality	° risk from direct inhalation of emissions - chronic	° relative population exposure - incinerator stack emissions	2,455 (Index)	- n/applicable	- 2,809 (Index)
			° relative population exposure - fugitive emissions	699 (Index)	- 699 (Index)	- 1,808 (Index)
			° relative future population exposure - incinerator stack emissions	2,440 (Index)	- n/applicable	- 2,976 (Index)

Note: [1] Values for road user indices divided by 1,000

TABLE A.3

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-1E	LF-1E/PI-27E	
					LF-1E	PI-27E
	A. RISK (Cont'd)					
	° Air Quality		° relative future population exposure - fugitive emissions	991 (Index)	- 991 (Index)	- 4,106 (Index)
		° risk from direct inhalation of emissions - acute	° topographic features on or around site	very flat - Lyons Creek approx. 1.5 km south of site, but not in a depression	- very flat - Lyons Creek approx. 1.5 km south of site, but not in a depression	- very flat - Welland River running east-west just north of site, but no noticeable topographic change
			° relative population exposure - upset emissions from incinerator stack	2,213 (Index)	- n/applicable	- 7,478 (Index)
			° relative population exposure - upset emissions from low elevation sources	260 (Index)	- 260 (Index)	- 156 (Index)
			° relative future population exposure - upset emissions from incinerator stack	5,480 (Index)	- n/applicable	- 11,701 (Index)
			° relative future population exposure - upset emissions from low elevation sources	248 (Index)	- 248 (Index)	- 138 (Index)
			° distribution of community facilities (# of facilities)	1	- 1	- 4
		° risks from ingestion of cistern and pond water	° relative exposure from cistern and pond water - incinerator stack emissions	0.70 (Index)	- n/applicable	- 0.14 (Index)
			° relative exposure from cistern and pond water - fugitive emissions	237.7 (Index)	- 237.7 (Index)	- 35.2 (Index)
		° risks from consumption of crops and livestock	° relative sensitive crop exposure - incinerator stack emissions	1,027,027 (Index)	- n/applicable	- 886,475 (Index)
			° relative sensitive crop exposure - fugitive emissions	5,025,001 (Index)	- 5,025,001 (Index)	- 3,154,755 (Index)
			° relative sensitive livestock exposure - incinerator stack emissions	80,100 (Index)	- n/applicable	- 67,665 (Index)

TABLE A.3

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-1E	LF-1E/PI-27E	
					LF-1E	PI-27E
	A. RISK (Cont'd)					
	° Air Quality		° relative sensitive livestock exposure - fugitive emissions	770,971 (Index)	- 770,971 (Index)	- 208,591 (Index)
			° relative future sensitive crop exposure - incinerator stack emissions	997,286 (Index)	- n/applicable	- 866,862 (Index)
			° relative future sensitive crop exposure - fugitive emissions	4,604,267 (Index)	- 4,604,267 (Index)	- 2,404,460 (Index)
			° relative future sensitive livestock exposure - incinerator stack emissions	79,848 (Index)	- n/applicable	- 62,965 (Index)
			° relative future sensitive livestock exposure - fugitive emissions	767,340 (Index)	- 767,340 (Index)	- 118,837 (Index)
	° Hydrogeologic Suitability	° capability to provide natural containment	° predictability of geologic condition	locally variable	- locally variable	- locally variable
			° contaminant breakthrough time	variable	- variable	- variable
		° ground water use	° availability of alternative ground water supplies	yes	- yes	- yes
			° existing ground water use and potential demand	potential for expansion	- potential for expansion	- potential for expansion
	° Surface Water Suitability	° susceptibility of site to flooding	° designated floodplains and floodprone areas	minor floodprone area reported along Carl Road/Morris Road intersection; no designated floodprone areas on site	- minor floodprone area reported along Carl Road/Morris Road intersection; no designated floodplains on site	- minor floodprone areas along Grassy Brook and Lyons Creek tributary; no designated floodplains on site
			° conveyance capacity	outlet swales have very mild slopes; site flooding due to insufficient downstream swale capacity is likely	- outlet swales have very mild slopes; site flooding due to insufficient downstream swale capacity is likely	- outlet swales have very mild slopes; site flooding due to insufficient downstream swale capacity is likely

TABLE A.3
Phase 4A - Detailed Comparative Evaluation
Comparative Evaluation of Siting Options
Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-1E	LF-1E/PI-27E	
					LF-1E	PI-27E
	A. RISK (Cont'd)					
	° Surface Water Suitability		° run-off potential	total upstream area draining through site is 0 ha	- total upstream area draining through site is 0 ha	- flooding constraint for this option associated with PI-27E; total upstream area draining through site is approximately 1,880 ha
		° potential for surface water use interference	° downstream water use index	14	15	
			° number of local stream takings for potable supply	0	0	

TABLE A.3

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-1E	LF-1E/PI-27E	
					LF-1E	PI-27E
SITE	B. ENVIRONMENTAL IMPACTS					
	° Residents	° displacement of residents	° number of residents displaced	43	42	
			° characteristics of residents displaced			
			- number over 65 yrs. of age	4	7	
			- number full-time farm households	3	3	
			- % of dwellings owned	93	92	
			- number of residents 5-13 years of age	5	4	
			- # of housewives	2	4	
			° attachment to place			
			- number of households at current address more than 20 years	6	4	
			- number of households in municipality more than 20 years	10	10	
			- number of households with ancestors who owned property	4	4	
			- number of households with ancestors who lived in municipality	6	8	
			- number of friends in area	35	32	
			- number of relatives in area	32	58	
	° Businesses	° displacement of businesses	° number and characteristics of businesses displaced			
			- number of businesses	6	7	
			- number of employees	22	33	
			- annual sales ($'000)	1,741	2,616	
	° Community Features and Services	° displacement of historical, community and recreation features	° number of features displaced	0	0	
			° number of significant features displaced	0	0	

TABLE A.3
Phase 4A - Detailed Comparative Evaluation
Comparative Evaluation of Siting Options
Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-1E	LF-1E/PI-27E	
					LF-1E	PI-27E
SITE (Cont'd)	B. ENVIRONMENTAL IMPACTS					
	° Community and Regional	° archaeological resources	° number of significant archaeological resources impacted	1	2[1]	
	° Land Use	° existing land uses	° existing land use pattern	2% commercial 98% rural/vacant	- 2% commercial - 98% rural/vacant	- 3% industrial - 97% rural/vacant
			° number of residences	16	15	
			° industrial and commercial facilities	commercial - 1 industrial - 0	commercial - 1 industrial - 1	
		° proposed and planned land uses	° land use designations	100% good general agriculture	- 100% good general agriculture	- 100% industrial
			° approved development proposals	none	none	
			° unapproved development proposals	none	none	
			° vacant lots of record	6	6	
			° local Official Plan policies	- prime agricultural designation - protective policies for farmland - O.P.A. not required if facilities qualify as "public use"	- prime agricultural designation - protective policies for farmland - O.P.A. not required if facilities qualify as "public use"	- industrial designation in draft O.P. - various types permitted - waste treatment facilities appear to be permitted - O.P.A. not required
			° regional Official Plan policies	- prime agricultural designation - protective policies for farmlands - waste treatment facilities permitted if impacts minimized - O.P.A. not required	- prime agricultural designation - protective policies for farmlands - waste treatment facilities permitted if impacts minimized - O.P.A. not required	- urban area designation - urban industrial development permitted in draft O.P. - waste treatment facilities may be permitted - O.P.A. not required
			° local zoning by-laws	100% rural agricultural	- 100% rural agricultural	- 100% rural agricultural (permits some industrial uses)
		° land use stability	° land sales	0	2	
			° development proposals	none	- see above	- see above
			° absentee land ownership			
			- area	33%	52%	
			- properties	16%	29%	

Note: [1] Assumes no facilities development north of rail line on PI-27E

TABLE A.3

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-1E	LF-1E/PI-27E	
					LF-1E	PI-27E
SITE (Cont'd)	B. ENVIRONMENTAL IMPACTS					
	° Land Use		° building quality			
			- good - fair - poor	69% 25% 6%	59% 35% 6%	
			° trends in land value	none	none	
	° Agricultural Resources	° displacement of farms with on-site headquarters	° number of farm operations owned	7	5	
			° number of farm operations rented	0	0	
			° average farm size owned (ha)	27	22	
			° average farm size rented (ha)	0	0	
			° gross farm revenue ($000s)	36.8	26.0	
		° loss of farmland	° soil capability (Class 1 equivalent)	177	91	
			° tile drainage (ha)	0	0	
	° Natural Environment	° rare species	° number of rare plant species[1]	6	8	
			° number of rare animal species	2	1	
		° natural vegetation displaced	° number of hectares of natural vegetation displaced	approximately 118 ha	approximately 83 ha	
		° potential for occurrence of other significant features	° level of potential for occurrence of significant features	high potential	high potential	

Note: [1] Species list determined for acquisition area identified at the end of Phase 5I

TABLE A.3

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-1E	LF-1E/PI-27E	
					LF-1E	PI-27E
SITE VICINITY	B. ENVIRONMENTAL IMPACTS					
	• Residents	• property value impacts	• potential for negative change in property values within 1500 m zone ($000)	679	1,050	
		• disruption of use and enjoyment of property and/or day-to-day activities (adjacent to site)	• # of residents adjacent to site and spending most time on property	6	11	
			• # of residents adjacent to site	31	42	
		• disruption of use and enjoyment of property and/or day-to-day activities (non-adjacent)	• # of residents spending most time on properties within 55 dBA noise impact zone	6	8	
			• # of residents within noise impact zone			
			- 50 dBA	4	7	
			- 55 dBA	21	33	
			• visual intrusion			
			- # of households within foreground	11	15	
			- # of households within middleground	35	57	
			• # of residents within site vicinity	737	850	
	• Businesses	• business activities that are negatively affected by the presence of OWMC facilities	• number	6	12	
			• employment	18	89	
			• annual sales ($'000)	1,333	2,192	
		• business activities that are positively affected by the presence of OWMC facilities	• number	1	12	
			• employment	2	1,450	
			• annual sales ($'000)	100	81,928	

TABLE A.3

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-1E	LF-1E/PI-27E	
					LF-1E	PI-27E
SITE VICINITY (Cont'd)	B. ENVIRONMENTAL IMPACTS					
	• Community Facilities and Services	• disruption of operations of community and recreation features (adjacent to site)	• # of sensitive features adjacent to site	0	0	
			• # of features adjacent to site	0	2	
		• disruption of operations of community and recreation features (site vicinity)	• # of sensitive features within noise impact zone	0	1	
			• # of features within noise impact zone	0	1	
			• # of sensitive features within site vicinity	6	6	
			• # of features within site vicinity	14	20	
	• Land Use	• existing land use	• existing land use pattern	5% other; 3% residential; 1% residential cluster; 91% rural/vacant	other -9%; residential 2%; residential cluster 1%; industrial -3%; rural/vacant 85%	
			• # of residences	215	206	
			• # of residences within 1000 m	56	74	
			• # of residences/1,000 ha (residences/1,000 ha)	92	75	
			• industrial and commercial facilities			
			- commercial	8	15	
			- industrial	0	11	
		• proposed and planned land use	• land use designations	1% - neighbourhood residential; 2% - general industrial; 57% - good general agriculture; 25% - rural; 10% - hazard lands; 5% - open space	residential - 1%; highway commercial - 1%; industrial - 23%; good general agriculture - 42%; hazard lands - 12%; open space - 6%; rural - 15%	

TABLE A.3

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-1E	LF-1E/P1-27E	
					LF-1E	P1-27E
SITE VICINITY (Cont'd)	B. ENVIRONMENTAL IMPACTS					
			° approved development proposals	none	- none	- 1 residential (2 units, 19.5 ha)
			° unapproved development proposals	none	none	
			° vacant lots of record	140	170	
			° local Official Plan policies	- prime agricultural designation on majority of lands (protective policies for farmlands) - significant residential neighbourhood (Cook's Mills) included in area (no pop. target assigned) - significant industrial lands (general industrial uses permitted)	- prime agricultural designation on most of area (protective policies for farmland) - significant industrial designation near P1-27E (various industrial use types permitted - draft O.P.) - significant highway commercial designation - future commercial development proposed - significant residential neighbourhood (Cook's Mills) included near LF-1E (no population target assigned)	
			° regional Official Plan policies	- prime agricultural designation (protective policies for farmlands) - no urban lands or development policies	- prime agricultural designation (protective policies for farmland) - substantial urban area designation near P1-27E - industrial uses proposed	
			° local zoning by-laws	- 90% agricultural (RA); 0.3% highway commercial (HC); 0.6% public/private open space (O2); 0.3% open space (O1); 0.1% shopping district (C2); 0.5% rural residential (RR1); 2.0% rural residential 2 (RR2); 6.2% rural (R)	- Hwy. Comm. (HC) 0.3%, pub. & priv. O.S. (O2) 0.6%, open space (O1) 0.3%, shopping dist. (C2) 0.1%, rural res. (RR 1) 0.6%, rural res. (RR 2) 1.9%, rural (R) 6.2%, agri. (RA) 90%	- open space (OS) 0.0%, gen. ind. (G1) 9.2%, Lt. Ind. (L1) 5.6%, hv. Ind. (HL) 13.3%, prestige ind. (P1) 3.0%, ind. (IND) 6.4%, hazard lands (HL) 12.0%, Hwy. Comm. (HC) 3.0%, agricultural (RA) 30.5%
		° provincial policies and plans	° Niagara Escarpment Plan	not affected	not affected	
			° Parkway Belt West Plan	not affected	not affected	
		° land use stability	° land sales (1983-84)	7	10	

TABLE A.3

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-1E	LF-1E/P1-27E	
					LF-1E	P1-27E
SITE VICINITY (Cont'd)	B. ENVIRONMENTAL IMPACTS					
		• land use stability	• development proposals	see above	see above	
			• absentee land ownership			
			- area	35%	44%	
			- properties	19%	29%	
			• building quality			
			- good	69%	69%	
			- fair	26%	27%	
			- poor	5%	4%	
			• trends in land value	Insufficient number of farmland sales in 1980-83 period to form a database on which to establish a trend	Insufficient number of farmland sales in 1980-83 period to form a database on which to establish trend	
	• Agricultural Resources	• partial displacement of farms (off-site farms with on-site land)	• # of farms with headquarters	2	2	
			• average parcel size (ha)	20	13	
			• proportion of land base lost (%)			
			- owned	25%	25%	
			- rented	35%	11%	
		• disruption of adjacent farm operations	• # of farms with headquarters	3	4	
			• # of operators with owned land	5	7	
			• livestock density (animal units/ha)	0.26	0.27	
		• disruption of non-adjacent vicinity operations	• # of farms with headquarters	25	23	
			• proportion of non-adjacent vicinity in crops (%)	41%	22%	
			• livestock density (animal units per ha)	0.25	0.25	
	• Natural Environment	• significant environmental units (SEU)	• areal extent of SEU	approximately 386 ha	approximately 636 ha	

TABLE A.3

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-1E	LF-1E/P1-27E	
					LF-1E	P1-27E
SITE VICINITY (Concluded)	B. ENVIRONMENTAL IMPACTS					
	° Natural Environment	° fish and wildlife features of significance	° number of significant features	2 features; pike spawning areas	4 features; 3 pike spawning areas, 1 waterfowl production area	
		° other natural vegetation	° areal extent	333 ha	892	
		° rare species	° number of rare plant species	3	5	
			° number of rare animal species	6	10	
	° Air Dispersion/ Air Quality	° restraints to dispersion	° local modifications to dispersion climatology	no significant modification	no significant modification	
		° existing and anticipated air quality	° existing air quality[1]	1.8 (mean index)	- 1.8 (mean index)	- 2.0 (mean index)
			° existing short-term air quality[2]			
			- SO_2	1,772	- 1,772	- 3,992
			- NO_x	244	- 244	- 418
			- TSP	7,684	- 7,684	- 26,445
			- THC	0	- 0	- 0
			° estimated effect on air quality - incinerator stack emissions[3]			
			- SO_2	1.0		1.0
			- NO_x	1.0		1.0
			- TSP	1.0		1.0
			- THC	1.0		1.0
			° estimated effect on air quality - fugitive emissions[4]	1.01	1.01	1.0

Notes: [1] Index describes the relationship between the existing annual averaged levels of SO_2, NO_x, TSP and THC and the ambient air quality

[2] Maximum short-term (1 hour) ambient air concentrations (pollutant loading index)

[3] Projected maximum annual increments of SO_2, NO_x, TSP and THC concentrations due to incinerator emissions. Index = $\frac{\text{Concentration attributed to facility and existing concentration}}{\text{existing concentration}}$

[4] Projected maximum annual increments of TSP and THC concentrations due to fugitive emissions. Index = $\frac{\text{Concentration attributed to facility and existing concentration}}{\text{existing concentration}}$

TABLE A.3

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-1E	LF-1E/PI-27E	
					LF-1E	PI-27E
COMMUNITY AND REGIONAL	B. ENVIRONMENTAL IMPACTS					
	• Community and Regional	• municipal finance	• net financial impact on area municipality ($'000)	168.4	135.8	
			• net financial impact on regional municipality ($'000)	100.3	79.1	
			• net financial impact on area municipality tax rate ($)	1.4	1.1	
			• stability index	251	255	
		• social stability	• municipal growth 1971 - 1981	6%	6%	
			• disruption through resident displacement (on-site residents)			
			- % of displaced households at current address more than 5 years	79%	69%	
			- % of displaced that are homeowners	93%	92%	
			- % of displaced households whose ancestors owned property	31%	33%	
			- % of displaced households whose ancestors lived in municipality	50%	67%	
			• disruption through out-migration (adjacent and vicinity residents)			
			- % of moving households that are homeowners	100%	100%	
			- % of moving households living at current address more than 5 years	89%	92%	
			- % of moving households whose ancestors owned property	11%	8%	
			- % of moving households whose ancestors lived in municipality	33%	42%	

TABLE A.3

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-1E	LF-1E/PI-27E	
					LF-1E	PI-27E
COMMUNITY B. AND REGIONAL (Cont'd)	ENVIRONMENTAL IMPACTS					
		° social cohesion	° disruption through resident displacement			
			- # of friends and relatives of those displaced	67	70	
			- # of displaced households with community group leaders	2	1	
			- # of displaced households with community group members	6	4	
			- # of displaced households with children	5	4	
			- # of children in displaced households	10	11	
			° disruption through out-migration			
			- # of moving households with community group leaders	2	3	
			- # of moving households with community group members	8	9	
			- # of moving households with children	6	7	
			- # of children in moving households	13	14	
			° # of community features contributing to cohesion disrupted	1	1	
		° community character/image	° compatibility with existing land uses			
			- existing non-industrial land use as a % of existing land use within 2 km	100%	100%	
			- existing non-industrial land use as a % of existing land use within 5 km	94%	97%	
			- designated non-industrial land use as a % of designated land use within 2 km	98%	77%	

TABLE A.3
Phase 4A - Detailed Comparative Evaluation
Comparative Evaluation of Siting Options
Data Matrix - Total Solidification

<table>
<tr><th>STUDY AREA</th><th>FACTOR GROUPING</th><th>FACTORS</th><th>INDICATORS</th><th>LF-1E</th><th colspan="2">LF-1E/PI-27E</th></tr>
<tr><th></th><th></th><th></th><th></th><th></th><th>LF-1E</th><th>PI-27E</th></tr>
<tr><td>COMMUNITY AND REGIONAL</td><td>B. ENVIRONMENTAL IMPACTS</td><td></td><td></td><td></td><td colspan="2"></td></tr>
<tr><td></td><td></td><td></td><td>- designated non-industrial land use as a % of designated land use within 5 km</td><td>86%</td><td colspan="2">92%</td></tr>
<tr><td></td><td></td><td></td><td>° heritage features</td><td></td><td colspan="2"></td></tr>
<tr><td></td><td></td><td></td><td>- average heritage value</td><td>25.9</td><td colspan="2">24.5</td></tr>
<tr><td></td><td></td><td></td><td>- density of structures</td><td>1.5</td><td colspan="2">1.3</td></tr>
<tr><td></td><td></td><td></td><td>- historic landscape (rank)[1]</td><td>2.0</td><td colspan="2">1.0</td></tr>
<tr><td></td><td></td><td></td><td>° visual compatibility</td><td></td><td colspan="2"></td></tr>
<tr><td></td><td></td><td></td><td>- with respect to land use (rank)[2]</td><td>1.0</td><td colspan="2">2.0</td></tr>
<tr><td></td><td></td><td></td><td>- intrusion on passing traffic (rank)[2]</td><td>3.0</td><td colspan="2">4.0</td></tr>
<tr><td></td><td></td><td>° regional and community economic base</td><td>° new regional jobs created</td><td>395</td><td colspan="2">422</td></tr>
<tr><td></td><td></td><td></td><td>° additional households</td><td></td><td colspan="2"></td></tr>
<tr><td></td><td></td><td></td><td>- region</td><td>165</td><td colspan="2">178</td></tr>
<tr><td></td><td></td><td></td><td>- area municipality</td><td>116</td><td colspan="2">125</td></tr>
<tr><td></td><td></td><td></td><td>° perceived impact on community economy</td><td></td><td colspan="2"></td></tr>
<tr><td></td><td></td><td></td><td>- businesses perceived positive impacts</td><td>7</td><td colspan="2">19</td></tr>
<tr><td></td><td></td><td></td><td>- businesses perceived negative impacts</td><td>9</td><td colspan="2">21</td></tr>
<tr><td></td><td></td><td>° tourism economy</td><td>° decline in tourist visitation and attendance</td><td>- a decline of 320,000 visitors in year following public hearings would occasion a loss of:
- $6.4 million in tourist expenditures
- $1.9 million in secondary income
- loss of 185 and 160 person-years of direct and secondary employment, respectively</td><td colspan="2">- a decline of 320,000 visitors in year following public hearings would occasion a loss of:
- $6.4 million in tourist expenditures
- $1.9 million in secondary income
- loss of 185 and 160 person-years of direct and secondary employment, respectively</td></tr>
</table>

Note: [1] rank 1.0 = facility inappropriate with existing trends in historic land use
rank 2.0 = facility inconsistent with existing trends in historic land use
rank 3.0 = facility consistent with existing trends in historic land use
[2] rank 1.0 = least impacted

TABLE A.3

Phase 4A - Detailed Comparative Evaluation
Comparative Evaluation of Siting Options
Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-1E	LF-1E/P1-27E	
					LF-1E	P1-27E
COMMUNITY AND REGIONAL (Cont'd)	B. ENVIRONMENTAL IMPACTS • Community and Regional	• tourism economy	• impact on tourism-related development plans	- at least two tourism operators indicated they are delaying and/or cancelling expansion plans until uncertainty created by OWMC situation is resolved	- at least two operators indicated they are delaying and/or cancelling expansion plans until uncertainty created by OWMC situation is resolved	
		• tourism operations	• future development potential	- delay/cancellation of expansion/upgrading plans could lead to an erosion of Niagara Falls' competitive position vis-à-vis other tourism destinations - such delays/cancellation of existing tourist operators may discourage new investors from proceeding with plans in Niagara Falls	- delay/cancellation of expansion/upgrading plans could lead to an erosion of Niagara Falls' competitive position vis-à-vis other tourism destinations - such delays/cancellation of existing tourist operators may discourage new investors from proceeding with plans for Niagara Falls - land designation for future tourism purposes in Official Plan may no longer be appropriate due to its proximity to OWMC facilities	
			• reduction in tourism visitation/occupancy rate:	- no evidence of an impact	- no evidence of an impact	- Niagara Meadows Holiday Park could experience impact on occupancy levels
			• presence of nuisance impacts	- no evidence of an impact	- no evidence of an impact	- Niagara Meadows Holiday Park could be affected
			• impacts related to tourism - related special views	- Minolta and Skylon Tower visual exposure to site should not occasion any significant adverse impact	- Minolta and Skylon Tower visual exposure to site should not occasion any significant adverse impact	- Minolta and Skylon Tower visual exposure should not occasion any significant adverse impact
			• visual exposure of passing tourist traffic to site	- no evidence of any significant impact	- no evidence of any significant impact	- traffic passing along QEW would have visual access to P1-27E and Niagara Meadows Holiday Park
	• Land Use	• existing land use	• existing land use pattern	2% residential cluster; 92% rural/vacant; 6% industrial	4% residential; 2% residential cluster; 4% industrial; 90% rural/vacant	
		• proposed and planned land use	• land use designations	1% resort commercial; 1% hwy. commercial; 25% rural/vacant; 14% industrial; 52% agricultural; 3% open space; 4% hazard lands	4% residential; 1% tourist commercial; 10% industrial; 3% open space; 3% hazard lands; 31% rural vacant; 47% good-general agricultural; 19% resort commercial	
			• local Official Plan policies	- significant part of residential designation in Welland (Cook's Mills Residential Neighbourhood) - substantial general industrial - prime agricultural land designations; protective policies for farmlands	- substantial parts of urban residential areas in southern Niagara Falls (Westlane and Drummond) est. pop. capacity - 10,000 - significant part of Cook's Mills residential neighbourhood in Welland outskirts - substantial general industrial designation - prime agricultural designation; protective policies for farmlands	

TABLE A.3

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

					LF-1E/PI-27E	
STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-1E	LF-1E	PI-27E
COMMUNITY &, AND REGIONAL (Cont'd)	ENVIRONMENTAL IMPACTS					
	° Land Use	° proposed and planned land use	° regional Official Plan policies	- significant part of Niagara Falls urban area - proposed industrial uses in O.P. - substantial prime agricultural land with protective policies	- prime agricultural designation; protective policies for farmlands - substantial urban area designation (Niagara Falls urban area) - proposed industrial uses in O.P.	
		° provincial policies and plans	° Niagara Escarpment Plan	not affected	not affected	
			° Parkway Belt West Plan	not affected	not affected	
	° Agricultural Resources	° stability of farm population	° % of operators under 55 years of age	65%	64%	
			° full-time operators (% of total operators)	16%	16%	
		° stability of land base	° tenure			
			- large parcels (% of land in parcels over 12.6 ha)	53%	51%	
			- owned farmland (% of total)	39%	27%	
			- area farmed (% of total)	62%	51%	
			° farm residences as % of total residences	17%	13%	
			° agriculturally designated land (Class 1 equiv.)	72%	50%	
			° private land ownership (% of total)	99%	97%	
		° disruption to the farm economy	° gross farm revenue ($M, 1981)	2.0	2.5	
			° relative exposure to fugitive emissions			
			- livestock index (M)	1.39	0.29	
			- crop index (M)	0.01	0.00	
			° relative exposure to stack emissions			
			- livestock index (M)	0.15	0.11	
			- crop index (M)	0.06	0.06	
			° downstream livestock	3	3	

TABLE A.3
Phase 4A - Detailed Comparative Evaluation
Comparative Evaluation of Siting Options
Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-1E	LF-1E/PI-27E	
					LF-1E	PI-27E
ACCESS ROADS	B. ENVIRONMENTAL IMPACTS					
	° Residents	° disruption of day-to-day activities and/or the use and enjoyment of property (adjacent)	° characteristics of residents			
			- # 0-5 years age	0	0	
			- # 6-15 years of age	0	0	
			- # over 65 years of age	2	3	
			° number of residents adjacent to access roads	17	9	
		° disruption of day-to-day activities and/or the use and enjoyment of property (vicinity)	° number of residents within noise impact zone	17	6	
			° number of residents within access road vicinity	60	60	
	° Community Features and Services	° disruption of operations of community and recreation features (adjacent)	° number of sensitive features adjacent to access road	0	0	
			° number of features adjacent to access road	4	1	
		° disruption of operations of community and recreation features (vicinity)	° number of sensitive features within noise impact zone	1	1	
			° number of features within noise impact zone	1	1	
			° number of sensitive features within access road vicinity	0	0	
			° number of features within access road vicinity	2	2	

TABLE A.3

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-1E	LF-1E/P1-27E		
					LF-1E		P1-27E
					to LF-1E	Between Sites	to P1-27E
ACCESS ROADS (Cont'd)	B. ENVIRONMENTAL IMPACTS						
	• Land Use	• existing land uses	• existing land use pattern				
			- residential	0%	0%	0%	0%
			- commercial	0%	0%	0%	0%
			- industrial	0%	0%	0%	0%
			- rural/vacant	96%	96%	100%	94%
			- residential cluster	0%	0%	0%	0%
			- other	4%	4%	0%	6%
			• number of residences	27	27	9	15
			• industrial facilities	0	0	0	0
			• commercial facilities	1	1	0	1
		• planned and proposed land uses	• land use designations				
			- agricultural	83%	83%	92%	66%
			- industrial	10%	10%	0%	20%
			- open space/hazard	7%	7%	8%	14%
			• approved development proposals	none	none	none	none
			• unapproved development proposals	none	none	none	none
			• vacant lots of record	17	17	10	10
			• local Official Plan policies	no hamlets or residential areas designated on route	- no hamlets or residential areas designated on route	- no hamlet or residential areas designated on route	- route through industrial and agricultural areas
			• regional Official Plan policies	no residential areas designated	- no residential areas designated	- no residential areas designated	- no residential areas designated
	• Agricultural Resources	• disruption to farm traffic and cattle crossings	• local roads				
			- agricultural vehicle impact index ('000)	0.12		0.12	
			- # of customer/service vehicle stops ('000)	0.00		0.00	
			- cattle crossings	0		0	

TABLE A.3

Phase 4A - Detailed Comparative Evaluation

Comparative Evaluation of Siting Options

Data Matrix - Total Solidification

STUDY AREA		FACTOR GROUPING	FACTORS	INDICATORS	LF-1E	LF-1E/PI-27E	
						LF-1E	PI-27E
ACCESS ROADS (Concluded)	B.	ENVIRONMENTAL IMPACTS (Concluded)					
	°	Agricultural Resources		° regional roads			
				- agricultural vehicle impact index ('000)	0,03	0,00	
				- number of customer/service vehicle stops (000)	0,00	0,00	
				- cattle crossings	0	0	
			° disruption to crop and livestock production	° adjacent crops ('000 ha)	0,34	0,40	
				° adjacent livestock ('000 of animal units)	0,05	0,08	
				° downstream livestock	0	0	
	°	Natural Environment	° fish communities	° spill pathway index	0	0	
				° downstream length of regionally significant fishery	0 km	0 km	
				° downstream length of locally significant fishery	0 km	0 km	

TABLE A.3
Phase 4A - Detailed Comparative Evaluation
Comparative Evaluation of Siting Options
Data Matrix - Total Solidification

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS	LF-1E	LF-1E/PI-27E	
					LF-1E	PI-27E
	C. ENGINEERING COST[1]					
	° Cost	° capital cost (1984 CAN. $000's)	° incinerator	56,031	56,031	
			° physical/chemical treatment	46,836	46,836	
			° solidification	11,808	11,808	
			° landfill	7,215	6,997	
			° on-site facilities (common)	55,509	55,509	
			° on-site facilities (site specific)	11,177	13,731	
			° off-site facilities (site specific)	3,490	3,090	
			° total estimated cost	192,066	191,512	
		° operating cost summary (1984 CAN. $000's)	° year 10	45,354	45,398	

Note: [1] Cost figures preliminary and subject to change

APPENDIX B

(Appendix to Chapter 4)

APPENDIX B
INTRODUCTION

Appendix B consists of the following tables:

TABLE B.1 Phase 4A Factor List - Comparison of Siting Options

TABLE B.2 Comparison of Phase 3B and Phase 4A Factors

TABLE B.3 Application of Site Selection Principles in Detailed Comparative Evaluation - Factor Identification

TABLE B.4 Relationship of Site Selection Objectives to the Phase 4A Factors Used in Comparing Siting Options

TABLE B.5 Change in Preliminary Factors/Indicators - Risk Factors

TABLE B.6 Change in Preliminary Factors/Indicators - Impact Factors/Engineering Factors

TABLE B.7 Risk Factor Rankings By Consultant

TABLE B.8 Public Input to Changes in Factor Ranking Levels

TABLE B.9 Application of Risk Factor Ranking Criteria

TABLE B.10 Application of Impact Factor Ranking Criteria For Highly Ranked Factors

TABLE B.11 Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

TABLE B.12 Application of Impact Factor Ranking Criteria For Low Ranked Factors

TABLE B.13 Impact Factor Rankings by Consultant

TABLE B.14 Reasons for Placing Factors in High Impact Factor Grouping

TABLE B.15 Reasons for Placing Factors in Low Impact Factor Grouping

Table B.1 provides a list of the Phase 4A factors and indicators employed in the detailed comparative evaluation of siting options.

Table B.2 compares the Phase 3B and Phase 4A factors. A rationale for the treatment of the Phase 3B factors and for new factors and indicators in Phase 4A is also provided.

Table B.3 indicates how the site selection principles were applied in Phase 4A factor identification. The principles are listed and their role in factor identification is provided.

Table B.4 documents the relationship of the OWMC site selection goals and objectives to the Phase 4A factors. Reasons for the consideration of each factor are provided.

Tables B.5 and B.6 document the changes to the preliminary risk and impact factors respectively. The preliminary Phase 4A factors and indicators are listed and the modified factors and indicators are provided. The table indicates whether the change was the result of screening, an addition or a modification to the preliminary factor list. Comments are provided, where appropriate.

Tables B.7 and B.13 provide the factor rankings by consultant for risk and impact factors, respectively. The consultants' ranking and the final ranking are provided.

Table B.8 documents the public input to changes in factor ranking. In all cases, the original factor rank and the final factor rank are provided. Public input is noted.

Table B.9 documents the application of factor ranking criteria to the Phase 4A risk factors. Severity of risk, frequency of occurrence, mitigation potential and public input are provided along with the factor rank.

Tables B.10, B.11 and B.12 document the application of impact factor ranking criteria for highly ranked, moderately ranked and low ranked factors, respectively. Ranking criteria are employed and reviewed with respect to magnitude, importance and tempering considerations.

Tables B.14 and B.15 provide the reasons for placing factors in the high or low factor grouping, respectively. The first column provides a listing of factors and the second column provides detailed reasons.

TABLE B.1

Phase 4A Factor List
Comparison of Siting Options

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS
	A. RISK		
	° Transportation	° province-wide hazard- based spill index of OWMC generated transport	° spill index due to motor vehicle accident involvements
			° spill index due to non-motor vehicle accident events
		° province-wide accident involvements of OWMC generated transport	° annual number of vehicles involved in accidents
		° transportation risks on local and regional access roads due to accident involvements of OWMC generated transport	° road user risk index due to accident involvements
		° transportation risks on local and regional access roads due to hazard-based spills of OWMC generated transport	° road user risk index associated with hazard-based spill index
			° population risk index associated with hazard-based spill index
			° sensitive community and recreation features risk index associated with hazard-based spill index
			° surface water suitability
			° hydrogeologic sensitive land risk index associated with hazard-based spill index
	° Air Quality	° risk from direct inhalation of emissions - chronic	° relative population exposure - incinerator stack emissions
			° relative population exposure - fugitive emissions
			° relative future population exposure - incinerator stack emissions

TABLE B.1

Phase 4A Factor List
Comparison of Siting Options

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS
	A. RISK (Cont'd)		
	° Air Quality		° relative future population exposure - fugitive emissions
		° risk from direct inhalation of emissions - acute	° topographic features on or around site
			° relative population exposure - upset emissions from incinerator stack
			° relative population exposure - upset emissions from low elevation sources
			° relative future population exposure - upset emissions from incinerator stack
			° relative future population exposure - upset emissions from low elevation sources
			° distribution of community facilities
		° risks from ingestion of cistern and pond water	° relative exposure from cistern and pond water - incinerator stack emissions
			° relative exposure from cistern and pond waters - fugitive emissions
		° risks from consumption of crops and livestock	° relative sensitive crop exposure - incinerator stack emissions
			° relative sensitive crop exposure - fugitive emissions
			° relative sensitive livestock exposure - incinerator stack emissions

TABLE B.1

Phase 4A Factor List
Comparison of Siting Options

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS
	A. RISK (Concluded)		
	Air Quality		° relative sensitive livestock exposure - fugitive emissions
			° relative future sensitive crop exposure - incinerator stack emissions
			° relative future sensitive crop exposure - fugitive emissions
			° relative future sensitive livestock exposure - incinerator stack emissions
			° relative future sensitive livestock exposure - fugitive emissions
	° Hydrogeologic Suitability	° capability of providing natural containment	° predictability of geologic condition
			° contaminant breakthrough time
		° ground water use	° availability of alternative ground water supplies
			° existing ground water use and potential demand
	° Surface Water Suitability	° susceptibility of site to flooding	° designated floodplains and flood-prone areas
			° conveyance capacity
			° runoff potential
		° potential for water use interference	° downstream water use index
			° number of local stream takings for potable supply

TABLE B.1

Phase 4A Factor List
Comparison of Siting Options

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS
SITE	B. ENVIRONMENTAL IMPACTS		
	° Residents	° displacement of residents	° number of residents displaced
			° characteristics of residents displaced
			° attachment to place of residents displaced
	° Businesses	° displacement of businesses	° number and characteristics of businesses displaced
	° Community and Recreation Features	° displacement of historical, community and recreation features	° number of features displaced
			° number of significant features displaced
		° archaeological resources	° number of significant archaeological resources impacted
	° Land Use	° existing land use	° existing land use pattern
			° number of residences
			° industrial and commercial facilities
		° proposed and planned land uses	° land use designations
			° vacant lots of record
			° local official plan policies
			° regional official plan policies
			° local zoning by-laws
		° land use stability	° land sales
			° absentee land ownership
			° building quality

TABLE B.1

Phase 4A Factor List
Comparison of Siting Options

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS
SITE (Concluded)	B. ENVIRONMENTAL IMPACTS		
	° Agricultural Resources	° displacement of farms with on-site headquarters	° number of farm operations
			° average farm size
			° gross farm revenue
		° loss of farmland	° soil capability (ha of Class 1 equivalents)
			° tile drainage
	° Natural Environment	° rare species	° number of rare plant species
			° number of rare animal species
		° natural vegetation displaced	° areal extent of natural vegetation displaced
		° potential for occurrence of additional significant biological features	° potential for occurrence of additional significant biological features

TABLE B.1

Phase 4A Factor List
Comparison of Siting Options

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS
SITE VICINITY	B. ENVIRONMENTAL IMPACTS		
	° Residents	° property value impacts	° none applied
		° disruption of day-to-day activities and/or use and enjoyment of property (adjacent to site)	° number of residents adjacent to site and spending most time on property
			° number of residents adjacent to site
		° disruption of day-to-day activities and/or use and enjoyment of property (non-adjacent)	° number of residents spending most time on properties within noise impact zone (55 dBA)
			° number of residents within noise impact zone
			° visual intrusion
			° number of residents within site vicinity
	° Businesses	° business activities negatively affected by the presence of OWMC facilities	° number and characteristics of businesses negatively affected by OWMC's presence
		° business activities positively affected by the presence of OWMC facilities	° number and characteristics of businesses positively affected by OWMC's presence
	° Community and Recreation Features	° disruption of operations of community and recreation features (adjacent to site)	° number of sensitive features adjacent to site
			° number of features adjacent to site
		° disruption of operations of community and recreation features (site vicinity)	° number of sensitive features within noise impact zone
			° number of features within noise impact zone

TABLE B.1

Phase 4A Factor List
Comparison of Siting Options

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS
SITE VICINITY (Continued)	B. ENVIRONMENTAL IMPACTS		
	° Community and Recreation Features		° number of sensitive features within site vicinity
			° number of features within site vicinity
	° Land Use	° existing land use	° existing land use pattern
			° number of residences
			° industrial and commercial facilities
		° proposed and planned land use	° land use designations
			° vacant lots of record
			° local official plan policies
			° regional official plan policies
			° local zoning by-laws
		° land use stability	° land sales
			° absentee land ownership
			° building quality
			° trends in land value
		° provincial policies and plans	° Niagara Escarpment Plan
			° Parkway Belt West Plan
	° Agricultural Resources	° partial displacement of farms (off-site farms with on-site land)	° number of farms affected
			° average parcel size
			° proportion of land base lost
		° disruption of adjacent farm operations	° number of farms with headquarters

TABLE B.1

Phase 4A Factor List
Comparison of Siting Options

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS
SITE VICINITY (Concluded)	**B. ENVIRONMENTAL IMPACTS**		
	° Agricultural Resources		° number of operators with owned land ° livestock density (animal units/ha)
		° disruption of non-adjacent vicinity farm operations	° number of farms with headquarters ° proportion of non-adjacent vicinity in crops (%) ° livestock density (animal units/ha)
	° Natural Environment	° Significant Environmental Units (SEUs)	° areal extent of SEUs
		° fish and wildlife features of significance	° number of significant features
		° other natural vegetation	° areal extent of other natural vegetation
		° rare species	° number of rare plant species ° number of rare animal species
	° Air Dispersion/ Air Quality	° restraints to dispersion	° local modifications to dispersion climatology
		° existing and anticipated air quality	° existing air quality ° existing short-term air quality ° estimated effect on air quality - incinerator stack emissions ° estimated effect on air quality - fugitive emissions

TABLE B.1

Phase 4A Factor List
Comparison of Siting Options

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS
COMMUNITY AND REGIONAL	**B. ENVIRONMENTAL IMPACTS**		
	° Community and Regional	° municipal finance	° net financial impact on area municipality and net financial impact on regional municipality
			° net financial impact on area municipality tax rate
		° social stability	° stability index
			° municipal growth 1971-1981
			° disruption through resident displacement (on-site residents)
			° disruption through out-migration (adjacent and vicinity residents)
		° social cohesion	° disruption through resident displacement
			° disruption through out-migration
			° number of community features contributing to cohesion disrupted
		° community character	° compatibility with land use
			° heritage features
			° visual compatibility
		° regional and community economic base	° new regional jobs created
			° additional households
			° perceived impact on community economy

TABLE B.1

Phase 4A Factor List
Comparison of Siting Options

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS
COMMUNITY AND REGIONAL (Continued)	B. ENVIRONMENTAL IMPACTS		
	° Community and Regional	° tourism economy	° decline in tourist visitation and attendance ° tourism-related development plans ° future development potential
		° tourism operations	° reduction in tourism visitation/occupancy rates ° presence of nuisance impacts ° impacts related to tourism - related special views ° visual exposure of passing tourist traffic to site
	° Land Use	° existing land use	° existing land use pattern
		° proposed and planned land use	° land use designations ° local official plan policies ° regional official plan policies
		° provincial policies and plans	° Niagara Escarpment Plan ° Parkway Belt West Plan
	° Agricultural Resources	° stability of farm population	° operator age (percent less than 55 years old) ° full-time operators
		° stability of agricultural land base	° tenure ° farm residences as % of total residences ° agriculturally designated land (Class 1 equiv.)

TABLE B.1

Phase 4A Factor List
Comparison of Siting Options

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS
COMMUNITY AND REGIONAL (Concluded)	**B. ENVIRONMENTAL IMPACTS**		
	° Agricultural Resources		° private land ownership
		° disruption to the farm economy	° gross farm revenue ° relative crop and livestock exposure to fugitive emissions ° relative crop and livestock exposure to stack emissions ° downstream livestock

TABLE B.1

Phase 4A Factor List
Comparison of Siting Options

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS
ACCESS ROADS	B. **ENVIRONMENTAL IMPACTS**		
	° Residents	° disruption of day-to-day activities and/or the use and enjoyment of property (adjacent)	° characteristics of residents ° number of residents adjacent to access roads
		° disruption of day-to-day activities and/or the use and enjoyment of property (vicinity)	° number of residents within noise impact zone ° number of residents within access road vicinity
	° Community and Recreation Features	° disruption of operations of community and recreation features (adjacent)	° number of sensitive features adjacent to access road ° number of features adjacent to access road
		° disruption of operations of community and recreation features (vicinity)	° number of sensitive features within noise impact zone ° number of features within noise impact zone ° number of sensitive features within access road vicinity ° number of features within access road vicinity
	° Land Use	° existing land uses	° existing land use pattern ° number of residences ° commercial facilities
		° planned and proposed land uses	° land use designations ° unapproved development proposals ° vacant lots of record ° local official plan policies ° regional official plan policies

TABLE B.1

Phase 4A Factor List
Comparison of Siting Options

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS
ACCESS ROADS (Concluded)	B. **ENVIRONMENTAL IMPACTS**		
	° Agricultural Resources	° disruption to farm traffic and cattle crossings	° local roads ° regional roads
		° disruption to crop and livestock production	° adjacent crops ° adjacent livestock ° downstream livestock
	° Natural Environment	° fish communities	° spill pathway index ° downstream length of regionally significant fishery ° downstream length of locally significant fishery

TABLE B.1

Phase 4A Factor List
Comparison of Siting Options

STUDY AREA	FACTOR GROUPING	FACTORS	INDICATORS
SITE	C. ENGINEERING[1]		
		° capital cost	° incinerator
			° physical/chemical treatment
			° solidification
			° on-site facilities (common)
			° landfill
			° on-site facilities (site specific)
			° off-site facilities
		° operating cost	° fixed cost
			° variable cost
			° start-up cost
			° decommissioning cost
			° post-closure and long-term costs
		° site area	° site size
			° landfill life
		° flexibility[1]	° facility design
			° facility layout

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[1] Facility design and facility layout factors were applied by the engineering consultant as a sensitivity analysis.

INTRODUCTION TO TABLE B.2

The following table compares Phase 3B and Phase 4A Factors. Column 1 lists all of the Phase 3B factors used in initial comparative evaluation. Column 2 explains how the Phase 3B factors were applied in Phase 4A. The new Phase 4A factor(s) which incorporates each Phase 3B factor is listed in column 3. The rationale for any change between Phase 3B and Phase 4A factors is provided in Column 4. This table should be read from top to bottom, by column for each Phase 3B factor rather than across the page by point.

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
1. FACTORS ON SITE			
1.1 Human Environment			
1.1.1 Existing Residents			
i) Number of people displaced	° Displacement of residents is an impact factor in Phase 4A. Several new indicators are used to assess impacts of displacement of residents.	I. Displacement of residents i) number of residents displaced ii) characteristics of residents displaced iii) attachment to place of residents displaced	° increased level of detail ° includes information from interviews with residents ° assesses sensitivity of population
ii) Number of residences displaced	° The number of residences on-site is an impact indicator used to assess existing land uses in Phase 4A.	I. Existing land use i) existing land use pattern ii) number of residences iii) industrial and commercial facilities	° reflects relationship of number of residences displaced to overall effects on land use
1.1.2 Existing Resources			
i) Number of farm building complexes	° In Phase 4A, this indicator becomes one factor with three specific indicators.	I. Displacement of farms with on-site headquarters i) number of farm operations ii) average farm size iii) estimated gross farm revenue	° increased level of detail ° assesses relative significance of farm displacements

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
1.1.2 Existing Resources (cont'd)			
ii) Cultivated land	° In addition to the factor "farms with on-site headquarters" characteristics of the displaced land are measured by a new factor and two new indicators.	I. Loss of farmland i) soil capability (Class 1 equivalent) ii) tile drainage	° increased level of detail and more specific measures of the use of land for agriculture were available in Phase 4A ° includes future resources
iii) Land fragmentation (urban shadow)	° Land fragmentation not applied in Phase 4A for on-site because more detailed and specific information on farm ownership was available in Phase 4A. ° Land fragmentation was considered for the community and region in Phase 4A.		° more site specific and detailed approach applied in Phase 4A
iv) Historical resources	° Historical resources are assessed as part of the "displacement of community and recreation features" factor in Phase 4A. (See 1.1.3 below)		° assessment of potential impacts on various types of community and recreation and historical features combined
v) Archaeological resource potential	° Archaeological resources are maintained as a site factor in Phase 4A.	I. Archaeological resources i) number of significant archaeological resources impacted	° increased level of detail possible with on-site investigations

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
1.1.2 Existing Resources (cont'd)			
vi) **Aquifer (ground water resources)**	° Aquifer distribution is considered as part of the new risk factor "ground water use" in Phase 4A.	I. Ground water use	° new factor grouping created to assess the hydrogeologic suitability of the sites specifically
		i) availability of alternative ground water supplies	
		ii) existing ground water use and potential demand	° aquifers part of ground water use considerations
1.1.3 **Existing Community and Recreational Features**			
i) **Public community features**	° These four indicators have been combined into one impact factor.	I. Displacement of community, recreation and historical features	° increased level of detail
ii) **Public recreation features**			° assesses relative significance of displacements
iii) **Private community features**		i) number of features displaced	
iv) **Private recreation features**		ii) number of significant features displaced	
1.1.4 **Existing Commercial and Industrial Uses**			
i) **Commercial facilities**	° These two indicators are considered under the existing land use factor and a revised factor.	I. Displacement of businesses	° increased level of detail
ii) **Industrial facilities**		i) number and characteristics of businesses displaced	° assesses relative significance of displacements
		ii) (See 1.1.1, Existing Land Uses)	° greater emphasis placed on economic analysis in Phase 4A

Table B.2

Comparison of Phase 3B and Phase 4A Factors

	TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
1.1.5	**Future Residents**			
i)	Projected population levels	° Projected population levels have been incorporated into assessment of "risk from direct inhalation of emissions" for air dispersion zones in Phase 4A.		° human health risk to future populations is public concern
ii)	Approved residential plans of subdivision	° Factors (ii) - (v) have been combined into one general land use factor in Phase 4A.	I. Proposed and planned land uses i) land use designations ii) local official plan policies iii) regional official plan policies iv) vacant lots of record v) local zoning by-laws	° factors for future land use expanded and combined to reflect importance of all future development
iii)	Residential land use designation (official plan)			
iv)	Residential zoning			
v)	Residential development proposals			
1.1.6	**Future Resources**			
i)	Soil capability	° Soil capability is used as an indicator for the "Loss of Farmland". (See 1.1.2 above)		° consolidates agricultural factors
ii)	Rural/agricultural land use designations	° Future agricultural resources are considered as both site and site vicinity agriculture factors. Displacement and site vicinity impact analyses assume areas currently designated industrial, commercial or residential will be removed from		° reflects incorporation of future impacts

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
1.1.6 Future Resources (cont'd)			
	agriculture. Under the new Community and Region Factor Grouping "agriculturally designated land" is an indicator for the factor "stability of land base". (See 1.1.2 above)		
iii) Provincial planning areas	° In Phase 4A provincial plans are assessed in the site vicinity and community and region study areas.	I. Provincial policies and plans i) NEC ii) Parkway Belt West Plan	° reflects planning areas
	° A new factor has also been added to assess land use stability.	I. Land use stability i) land sales ii) absentee land ownership iii) building quality	° reflects increased level of analysis
1.1.7 Future Commercial and Industrial Uses			
i) Planned and proposed commercial facilities	° Factors (i) and (ii) have been combined into "proposed and planned land use". (See 1.1.5 above)		° consolidated land use planning factors
ii) Planned and proposed industrial facilities			

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
1.2 Physical and Biological Environment - Site and Site Vicinity			
1.2.1 Hydrogeology			
i) Regional category	° In Phase 4A, hydrogeological concerns have been combined into a factor grouping called "Risks Related to Hydrogeologic Suitability".	I. Capability to provide natural containment	° increased level of detail reflecting on site investigations and modelling techniques
ii) Thickness of confining layer			
iii) Geologic predictability		i) predictability of geologic condition	
iv) Material texture		ii) contaminant breakthrough time	° directed in part, towards providing input to analysis of potential risk to human health
v) Oil and gas wells			
			° relates tó second level of protection
1.2.2 Biology		Site	
i) Significant Environmental Units (SEUs)	° A more detailed analysis takes place regarding these indicators in Phase 4A under the factor grouping Natural Environment Impacts. Site and site vicinity factors have been differentiated in Phase 4A.	I. Rare species	° increased level of detail
ii) Non-SEU woodlots >20 ha		i) number of rare plant species	° reflects on-site investigations
iii) Other vegetation		ii) number of rare animal species	° reflects response to public concern
iv) Aquatic habitat			
v) Terrestrial wildlife habitat		II. Natural vegetation displaced	
vi) Local setting		i) areal extent of natural vegetation displaced	

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
1.2.2 Biology (cont'd)			
		III. Potential for occurrence of additional significant biological features	
		i) potential for occurrence of significant features	
		Site Vicinity	
		I. Significant Environmental Units	
		II. Fish and wildlife features of significance	
		i) number of significant features	
		III. Other natural vegetation	
		i) areal extent of other natural vegetation	
		IV. Rare species	
		i) number of rare plant species	
		ii) number of rare animal species	

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
1.2.3 Atmospheric Conditions		Impact Factors	
i) Existing air quality	° A new approach is taken to atmospheric conditions in Phase 4A. Air quality is applied in both risk and impact factor groupings. The impact factors are applied to the site vicinity study area.	I. Restraints to dispersion	° reflects greater level of detail and modelling techniques used Phase 4A
ii) Topography		i) local modifications to dispersion climatology	° reflects concern with air quality as a natural resource
iii) Receptors			
		II. Existing and anticipated air quality	
		i) existing air quality	
		ii) existing short-term air quality	
		iii) estimated effect on air quality - incinerator stack emissions	
		iv) estimated effect on air quality - fugitive emissions	
		Risk Factors	
		I. Risk from direct inhalation of emissions - chronic	° response to major public concern regarding human health effects
		i) relative population exposure - incinerator stack emissions	° reflects greater level of datail and modelling techniques used in Phase 4A
		ii) relative population exposure - fugitive emissions	

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
1.2.3 Atmoshperic Conditions (cont'd)			
		iii) relative future population exposure - incinerator stack emissions	
		iv) relative future population exposure - fugitive emissions	
		II. Risk from direct inhalation of emissions - acute	
		i) topographic feature on or around site	
		ii) relative population exposure - upset emissions from incinerator stack	
		iii) relative future population exposure - upset emissions from low elevation sources	
		iv) relative future population - upset emissions from incinerator stack	
		v) relative future population - upset emissions from low elevation sources	
		vi) distribution of community facilities	

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
1.2.3 Atmospheric Conditions (cont'd)			
		III. Risks from ingestion of cistern and pond water	° reflects greater emphasis on pathways for contaminants to humans
		i) relative exposure from cistern and pond water - incinerator stack emissions	
		ii) relative exposure from cistern and pond water - fugitive emissions	
		IV. Risks from consumption of crops and livestock	° reflects greater emphasis on pathways for contaminants to humans
		i) relative sensitive crop exposure - stack emissions	
		ii) relative sensitive crop exposure - fugitive emissions	
		iii) relative sensitive livestock exposure - stack emissions	
		iv) relative sensitive livestock exposure - fugitive emissions	
		v) relative future sensitive crop exposure - stack emissions	
		vi) relative future sensitive crop exposure - fugitive emissions	

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
1.2.3 Atmospheric Conditions (cont'd)			
		vii) relative future sensitive livestock exposure - stack emissions	
		viii) relative future sensitive livestock exposure - fugitive emissions	
1.3 Costs/Operations			
1.3.1 Land Acquisition			
i) Land value	° Land value is an input in the consideration of capital cost of the facility. ° A second cost factor has been added for operating costs.	I. Capital cost i) incineration ii) phys/chem treatment iii) solidification iv) on-site facilities v) engineered landfill vi) on-site facilities (site specific) vii) off-site facilities	° increased level of detail ° reflects engineering input in Phase 4A

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
1.3.1 Land Acquisition (cont'd)		II. Operating cost	
		i) fixed cost	
		ii) variable cost	
		iii) start-up	
		iv) decommission	
		v) post-closure and long-term	
ii) Land fragmentation	• A revised factor has been added in Phase 4A which incorporates both of these indicators in a modified form for off-site impacts only.	I. Stability of agricultural land base	• reflects major impact on agricultural land use
iii) Publicly owned land		i) tenure	• land fragmentation and ownership also considered in definition of parcel options and in choice of preferred access routes
		ii) farm residences as % of total residences	
		iii) agriculturally designated land (Class 1 equivalent)	
		iv) private land ownership (% of total)	
1.3.2 Site Improvements			
i) Surface drainage	• A new factor has also been added covering risk from surface water contamination.	I. Susceptibility to flooding	
		i) designated floodplains and flood-prone areas	• greater level of detail • reflects public concern with risk to human health
		ii) runoff potential	
		iii) conveyance capacity	

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
1.3.2 Site Improvements (cont'd)		II. Potential for water use interference	
		i) downstream water use index	
		ii) number of local stream takings for potable supply	
1.3.3 Utilities, Roads, Airports			
i) Utility transmission lines - rerouting	° A generalized review of the impacts of utility corridors was conducted in Phase 4A.		° utility corridors to occur along existing road allowances, therefore impacts will be minimal ° assessment of impacts considered to be a Phase 4B activity
ii) Road closure required	° In Phase 4A road closures are considered as part of the estimated cost factors. (See 1.3.1, Capital Cost Factor)		° reflects consolidation of cost impacts ° further assessment of road closure impacts considered to be a Phase 4B activity
iii) Airport - incinerator stack conflict with air navigation	° This indicator was used only to refine site boundaries in Phase 4A, and as input to defining incinerator stack height.		° not significant in comparing siting options

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
1.3.4 Site Size and Configuration			
i) Total area	° Modified factor in Phase 4A. In addition, a new factor was added to assess flexibility for existing and future development.	I. Site area i) site size ii) landfill life	° an emphasis was placed on minimizing site size in developing landfill and plant operations configurations ° in addition, site area was a factor in Phase 4A. Emphasis was placed on maximizing landfill life.

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
2. FACTORS IN SITE VICINITY			
2.1 Human Environment			
2.1.1 Existing Residents		Impact	
i) Number of people ii) Number of residences	° In Phase 4A, effects on people are considered in both risk and impact factors. Three new impact factors have been added - "disruption day-to-day activities and/or use and enjoyment of property" (adjacent to site and non-adjacent) and "economic stability of the residents". In addition, "number of residences" is an indicator for the existing land use factor. (See 2.1.4)	I. Disruption of day-to-day activities and/or use and enjoyment of property (adjacent to site)	° reflects increased level of detail ° consolidates significance of various impacts on residents
		i) number of residents adjacent to site and spending most time on property	
		ii) number of residents adjacent to site	
		II. Disruption of day-to-day activities and/or use and enjoyment of property (non-adjacent site vicinity)	
		i) number of residents spending most time on properties within noise impact zone (55 dBA)	
		ii) number of residents within noise impact zone	
		iii) visual intrusion	
		iv) number of residents within site vicinity	

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
2.1.1 Existing Residents (cont'd)			
		III. Property value impacts	
		i) no indicators	
		Risk	
	° In addition, two factors to assess risk to residents from water use have been added. (See 1.1.2 above for "ground water use" factor). Other factors were added in Phase 4A to assess transportation and air quality risks to populations. (See 1.1.2, 1.2.1 and 1.2.3)	I. Potential for surface water use interference	° reflects increased scope of work
		i) downstream water use index	° response to public concern regarding human health
		ii) number of local stream takings for potable supply	
2.1.2 Existing Resources			
i) Number of farm building complexes	° Indicators (i) - (iii) have been expanded in Phase 4A. Two community and region factors have also been added.	I. Partial displacement of farms (off-site farms with on-site land)	° reflects increased level of detail and primary data sources added
ii) Sensitive crops		i) number of farms affected	° Includes assessment of economic effects of potential air quality changes on value of farm livestock products
iii) Livestock populations	° Potential bioaccumulation of contaminants in sensitive crops and livestock is also assessed for the air dispersion zones with reference to risk to human health. (See 1.2.3)	ii) average size of parcels lost	
		iii) proportion of land base lost	
		II. Disruption of adjacent farm operations	
		i) number of farms with headquarters	

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
2.1.2 Existing Resources (cont'd)			
		ii) number of operators with owned land	
		iii) livestock density (animal units/ha)	
		III. Disruption of non-adjacent vicinity operations	
		i) number of farms with headquarters	
		ii) proportion of non-adjacent vicinity in crops	
		iii) livestock density (animal units per ha)	
		Community and Region	
		IV. Stability of farm population	° reflects increased level of analysis to broad community level
		i) operator age (% less than 55 years old)	
		ii) full-time operators (% of total operators)	
		V. Disruption to the farm economy	° reflects increased level of analysis to broad community areas
		i) gross farm revenue	

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
2.1.2 Existing Resources (cont'd)			
		ii) relative crop and livestock exposure to fugitive emissions	
		iii) relative crop and livestock exposure to stack emissions	
		iv) downstream livestock	
2.1.3 Existing Community and Recreational Features			
i) Public community features	° In Phase 4A these four indicators have been combined into two new site vicinity factors that address the effects on community and recreation features in detail.	I. Disruption of operations of community and recreation features (adjacent to site)	° consolidates impact assessment for community and recreation features
ii) Public recreational features			
iii) Private community features		i) number of sensitive features adjacent to site	° reflects relative significance of impacts through increased level of detail
iv) Private recreational features		ii) number of features adjacent to site	° differentiates significance of features
		II. Disruption of operations of community and recreation features (non-adjacent site vicinity)	
		i) number of sensitive features within noise impact zone	
		ii) number of features within noise impact zone	

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
2.1.3 Existing Community and Recreational Facilities (cont'd)			
		iii) number of sensitive features within site vicinity	
		iv) number of features within site vicinity	
v) Known archaeological and historical sites	° This factor is revised and maintained in Phase 4A. (See 1.1.2 above for the site study area only)		° reflects greater level of detail enabled through on site investigations ° no impacts in site vicinity anticipated
2.1.4 Existing Community Character and Lifestyle			
i) Land use pattern	° In Phase 4A, a new approach is taken to dealing with "Existing Community Character and Lifestyle". A new Factor Grouping has been created to assess Community and Regional impacts.	I. Regional and community economic base	° reflects increased level of detail and analysis
ii) Social and economic character		i) new regional jobs created	° reflects greater emphasis on economic impacts in Phase 4A
		ii) additional households	
		iii) perceived impact on community economy	
		II. Tourism economy	
		i) decline in tourist visitation and attendance	

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
2.1.4 Existing Community Character and Lifestyle (cont'd)			
		ii) tourism-related development plans	
		iii) future development potential	
	° Factors specific to economic base, community character and existing land use are included. A "tourism economy" factor has been added to assess tourism at the same level as industrial, commercial and farm economies. (See 2.1.2, p.17) In addition, three other factors have been added to provide more detail of social and economic impacts at a community and regional level.	III. Community character	° reflects increased level of detail and analysis
		i) compatibility with existing land uses	
		ii) heritage features	
		iii) visual compatibility	
		IV. Existing land use (site vicinity)	
		i) existing land use pattern	
		ii) number of residences	
		iii) industrial and commercial facilities	
		V. Existing land use (community and region)	
		i) existing land use pattern	

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
2.1.4 Existing Community Character and Lifestyle (cont'd)			
		VI. Social cohesion	
		i) disruption through resident displacement	
		ii) disruption through out-migration	
		iii) number of community features contributing to cohesion disrupted	
		VII. Social stability	
		i) stability index	
		ii) municipal growth 1971 - 1981	
		iii) disruption through resident displacement (on-site residents)	
		iv) disruption through out-migration (adjacent and vicinity residents)	
		VIII. Municipal finance	
		i) net financial impact on area municipality and net financial impact on regional municipality	
		ii) net financial impact on area municipality tax rate	

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
2.1.5 Future Residents			
i) Projected population levels	° In Phase 4A, projected population levels used only to assess potential risk to human health from air dispersion effects. The social, economic and land use consultants also considered future growth and development in their analyses.		° human health risk to future populations is major concern
ii) Approved residential plans of subdivision	° Indicators (ii) - (v) have been combined into one general land use factor in Phase 4A. This factor is applied at both the site vicinity and community and region levels. See also 1.1.6 "provincial policies and plans".	I. Proposed and planned land use (Site Vicinity) i) land use designations ii) vacant lots of record iii) local official plan policies iv) regional official plan policies v) local zoning by-laws II. Proposed and planned land use (Community and Region) i) land use designations ii) local official plan policies iii) regional official plan policies	° consolidates land use impact factors
iii) Residential land use designations			
iv) Residential zoning			
v) Residential development proposals			

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
2.1.5 Future Residents (cont'd)			
	° A new factor has also been added to assess changes in land use stability.	III. Land use stability i) land sales ii) absentee land ownership iii) building quality iv) trends in land value	
2.1.6 Future Resources			
i) Soil capability class	° In Phase 4A, soil capability class is not being used as a specific factor for site vicinities. The stability of agricultural land base factor applied to the community and region includes a corresponding measure for Class 1 equivalent land. (See sec.2.2)		° impacts on future resources not significant in site vicinity ° reflects increased level of detail
ii) Rural/Agricultural land use designation	° This indicator has been maintained in Phase 4A. (See 2.1.5 above for the site vicinity and community and region study areas)		
2.1.7 Existing Commercial and Industrial Uses			
i) Commercial facilities ii) Industrial facilities	° These two indicators have been combined into two factors for Phase 4A. The factors have been modified to reflect positive and	I. Business activities negatively affected by presence of OWMC facilities	° reflects increased level of detail and public contacts

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
2.1.7 Existing Commercial and Industrial Uses (cont'd)			
	negative business impacts. A new factor has been added to assess impacts on tourism operations.	i) number and characteristics of businesses negatively affected by OWMC's presence	° the emphasis is on potential effects on operations of commercial and industrial uses in the site vicinity study areas
		II. Business activities positively affected by presence of OWMC facilities	° factors have been chosen to reflect significance and direction of effect on operations
		i) number and characteristics of businesses positively affected by OWMC's presence	
		III. Tourism operations	° tourism factor added so that agriculture, tourism and commercial and industrial uses treated separately and equally
		i) reduction in tourism visitation/occupancy rates	
		ii) presence of nuisance impacts	
		iii) impacts related to tourism related special views	
		iv) visual exposure of passing tourist traffic to site	
2.1.8 Future Commercial and Industrial Uses			
i) Planned and proposed commercial facilities	° All future land uses have been combined into one factor. (See 2.1.5, (ii) - (v))		

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
2.1.8 Future Commercial and Industrial Uses (cont'd)			
ii) Planned and proposed industrial facilities			
2.2 Costs (Off-site)/Operations			
i) Proximity to rail access	° Rail access is considered as an opportunity in Phase 4A. Specific factors are applied to a rail access study area		

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
3. **ACCESS ROADS - LOCAL**	° All of the Phase 3B factors listed in column one were used in preliminary screening of local and regional access routes in Phase 4A with some modifications to the transportation and agricultural consultants' factors. The comments listed in this table refer only to treatment of factors used in the second stage of Phase 4A analysis of access routes and to access route factors used in the comparison of siting options. ° In Phase 4A, all factors were considered equally for local and regional access routes. ° In Phase 4A, two approaches were taken to access route analysis for siting option comparison. First, risks associated with transportation were assessed as part of the generic risk assessment process. Second, impact factors associated with access routes were applied by the site selection team.		
3.1 **Human Environment**			
3.1.1 **Transportation Safety**	Transportation Risk Factors		
i) **Proximity to arterial roads**	° Four new transportation risk factors were applied in Phase 4A. Two apply to province-wide access routes and two apply to local and regional routes.	I. Province-wide hazard based spill index of OWMC generated transport	° reflects greater level of detail ° reflects emphasis on risk to human health
ii) **Proximity to freeways**			

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
3.1.1 Transportation Safety (cont'd)			
iii) Difficulity of access (number of level railway crossings)		i) spill index due to motor vehicle accident involvements	° reflects increased use of modelling and combining of receptor data and transportation accidents and spills data
iv) Number of intersections where a turn is required		ii) spill index due to non-motor vehicle accident events	
		II. Province-wide accident involvements of OWMC generated transport	
		i) number of vehicles involved in accidents	
		III. Transportation risks on local and regional access roads due to accident involvements of OWMC generated transport	
		i) road user risk index due to accident involvements	
		IV. Transportation risks on local and regional access roads due to hazard based spills of OWMC generated transport	
		i) road user risk index associated with hazard based spill index	
		ii) population risk index associated with hazard based spill index	

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
3.1.1 Transportation Safety (cont'd)			
		iii) sensitive community and recreation features risk index associated with hazard based spill index	
		iv) surface water suitability	
		v) hydrogeologic sensitive land risk index associated with hazard based spill index	
3.1.2 Existing Residents			
i) Number and size of population concentrations	° Two factors were applied in Phase 4A to assess disruption to residents along access routes.	I. Disruption of day-to-day activities and/or the use and enjoyment of property (adjacent)	° reflects greater level of detail
ii) Number of residences		i) characteristics of residents	° enables significance of study areas to be assessed separately
iii) Estimated population along access roads		ii) number of residents adjacent to access roads	
iv) Distance through residential strip development			
		II. Disruption of day-to-day activities and/or the use and enjoyment of property (vicinity)	
		i) number of residents within noise impact zone	
		ii) number of residents within access road vicinity	

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
3.1.2 Existing Residents (cont'd)			
	° A new factor encompassing impacts on all existing land use was added in Phase 4A.	I. Existing land use	° combines related indicators
		i) existing land use pattern	
		ii) number of residences	
		iii) commercial facilities	
3.1.3 Existing Resources			
i) Number of active farm building complexes	° Two factors were applied in Phase 4A to assess impacts on agriculture along access roads.	I. Disruption to crop and livestock production along access roads	° reflects greater level of detail
ii) Livestock populations		i) adjacent crops	° major public concern
		ii) adjacent livestock	
		iii) downstream livestock	
		II. Disruption to farm traffic and cattle crossings along access roads	
		i) local roads	
		ii) regional roads	
3.1.4 Existing Community and Recreational Facilities			
i) Community features ii) Recreation features	° The community and recreation features factors have been expanded to reflect two different study areas in Phase 4A.	I. Disruption of operations of community and recreation features (adjacent)	° reflects greater level of detail

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
3.1.4 Existing Community and Recreational Facilities (cont'd)			
		i) number of sensitive features adjacent to access road	° reflects differences in impacts for different study areas
		ii) number of features adjacent to access road	
		II. Disruption of operations of community and recreation features (vicinity)	
		i) number of sensitive features within noise impact zone	
		ii) number of features within noise impact zone	
		iii) number of sensitive features within access road vicinity	
		iv) number of features within access road vicinity	
3.1.5 Future Residents			
i) Distance through residential land use designations	° All impacts on planned and proposed land uses were combined into one factor in Phase 4A.	I. Planned and proposed land uses	° combines related indicators
		i) land use designations	
		ii) unapproved development proposals	
		iii) vacant lots of record	

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
3.1.5 Future Residents (cont'd)			
		iv) local official plan policies	
		v) regional official plan policies	
3.1.6 Future Resources			
i) Length across Class 1 equivalent agricultural land	° Not applied for the access road study area in Phase 4A.		° impacts negligible for agricultural land along access roads ° unlikely event of occurrence, mitigation is possible
3.1.7 Existing Commercial and Industrial Uses			
i) Distance through commercial areas	° These factors were combined into a single existing land use factor. (See 3.1.2 above)		° combines related indicators
ii) Distance through industrial areas			
3.1.8 Future Commercial and Industrial Use			
i) Distance through designated commercial areas	° See 3.1.5 above.		° modification reflects increased level of detail and aggregation of related indicators
ii) Distance through designated industrial areas			

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
3.2 Physical and Biological Environment			
3.2.1 Hydrogeology			
i) Length of sensitive lands crossed	° This measure was applied as an indicator of risk related to spills for local and regional access roads. (See 3.1)		° differences between siting options negligible ° mitigation of spills is possible
3.2.2 Stream Crossings			
i) Number of stream crossings and constraint rating	° This factor has been modified in Phase 4A.	I. Fish communities i) spill pathway index ii) downstream length of regionally significant fishery iii) downstream length of locally significant fishery	° reflects greater level of detail and site specific data

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION		TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
4.	ACCESS ROADS - REGIONAL			
4.1	Human Environment			
4.1.1	Transportation Safety			
i)	Transportation accident frequency	° See 3.1.1.		° increased level of detail ° consistency of approach
ii)	Distance to freeways	° Not applied in Phase 4A, See 3.1.1.		° no longer of significance after new factors added in Phase 4A
iii)	Total number of level railway crossings	° Not applied in Phase 4A, See 3.1.1.		° increased accident rate at rail crossings part of overall accident analysis
iv)	Number of intersections where a turn is required	° Not applied in Phase 4A, See 3.1.1.		
4.1.2	Existing Residents			
i)	Distance through strip residential development	° See 3.1.2.		
ii)	Number of communities by population	° See 3.1.2.		
4.1.2	Existing Residents (cont'd)			
iii)	Estimated population along access routes	° See 3.1.2.		

Table B.2

Comparison of Phase 3B and Phase 4A Factors

TREATMENT PHASE 3B INITIAL COMPARATIVE EVALUATION	TREATMENT IN PHASE 4A	NEW FACTORS AND INDICATORS IN PHASE 4A	RATIONALE
4.1.3 Existing Resources			
i) Number of active farm building complexes	° See 3.1.3.		
ii) Sensitive crops	° See 3.1.3.		
iii) Livestock populations	° See 3.1.3.		
4.1.4 Existing Community and Recreation Features			
i) Number and type of community and recreation features	° See 3.1.4.		
4.2 Physical and Biological Environment			
4.2.1 Hydrogeology			
i) Length of sensitive lands crossed (m)	° See 3.2.1.		
4.2.2 Stream Crossings			
i) Stream crossing and constraint rating	° See 3.2.2.		

TABLE B.3

Application of Site Selection Principles in Detailed Comparative Evaluation

Factor Identification

Principles	Role In Phase 4A Factor Identification
Progressive Refinement of the Search Process	o wider study area around each candidate site than during Phase 3B (2 km) o wider study area along access routes than during Phase 3B o new study areas added (air dispersion zones rail access routes, community and region) o broader range of risks, impacts and costs considered o additional investigations included on-site investigations, extensive public and agency contacts, generic risk analysis, extensive engineering inputs, an on-site drilling program, detailed air quality and transportation interpretations and modelling, the inclusion of a broader range of factors, consideration of construction effects and mitigation techniques.
Definition of the Environment	o factors encompass range of human health risks (i.e., air quality, hydrogeologic, transportation, hydrologic), impacts (i.e., natural environment, economic, social, land use, agricultural, archaeological, community and recreational, transportation and engineering considerations).
Protection of Human Health and the Environment	o four factor groupings relate to risk to human health (transportation, air dispersion, surface water suitability, and hydrogeologic suitability) o factors relate to risk from exposure to contaminants through five pathways - air (inhalation), ground and surface water (ingestion), bioaccumulation (ingestion), and transportation (direct exposure)

TABLE B.3

Application of Site Selection Principles in Detailed Comparative Evaluation Factor Identification

Principles	**Role In Phase 4A Factor Identification**
Protection of Human Health and the Environment (cont'd)	o seven factor groupings relate to impacts on the environment (residents, businesses, community facilities and services, community and region, land use, agricultural resources and natural environment).
The Involvement of Those Affected	o Walk and Talk program involved interviews with residents within the site vicinity and along access routes and contacts with a variety of agency and government offices. Results of these contacts were incorporated into definition of factors and provided a large portion of the data base o further public and agency input to factor clarification and application was attained through interviews and meetings as part of the "Walk and Talk" program and through a series of OWMC public workshops. Concerns incorporated into factor identification, clarification and application.
A Second Level of Protection of the Environment	o particular emphasis in factor identification placed on hydrogeologic and surface drainage settings which would tend to inhibit the migration of contaminants in the vicinity of sites o consideration in transportation risk and air quality risk analysis.
Likelihood of Suitability	o where there was strong evidence that a candidate site would not be suitable irrespective of the relative ranking at a site on the basis of other siting considerations, such sites were considered unsuitable.

TABLE B.3

Application of Site Selection Principles in Detailed Comparative Evaluation Factor Identification

Principles	Role In Phase 4A Factor Identification
The Maintenance of Choice	o an effort was made to maintain the flexibility to further minimize risks, impacts and costs and to enhance benefits through design and operational refinements and through site specific mitigative and compensation measures. It was recognized that the exact nature of such measures will be highly dependent on discussions with local municipalities and residents o reflected by a sensitivity test using flexibility factors.

TABLE B.4

Relationship of Site Selection Objectives to the Phase 4A Factors Used in Comparing Siting Options

	OWMC GOALS AND OBJECTIVES	RELATED FACTORS	STUDY AREA(S)	REASONS FOR CONSIDERATION/COMMENT
I	GOAL To select a site(s) which minimizes risk to human health.			
	Objectives			
A.	Site - "pathways" into the environment			
1.	To site facility components in hydrogeologic settings that will naturally restrict the movement of contaminants and protect ground water resources and to utilize engineering measures where required to ensure maximum environmental safety.	° capability to provide natural containment ° ground water use	° site ° site vicinity	for both factors: ° second level of protection concern ° refinement of previously collected data ° major public concern ° engineering measures addressed ° mitigation measures addressed
2.	To site facility components in hydrogeologic settings that will naturally restrict the movement of contaminants and protect human health, surface water resources and aquatic ecosystems.	° capability to provide natural containment ° ground water use ° surface water use	° site ° site vicinity	for both factors: ° second level of protection concern ° refinement of previously collected data ° major public concern ° engineering and mitigation measures addressed ° includes treatment of human health issue ° feeds into generic risk assessment

TABLE B.4

Relationship of Site Selection Objectives to the Phase 4A Factors Used in Comparing Siting Options

OWMC GOALS AND OBJECTIVES	RELATED FACTORS	STUDY AREA(S)	REASONS FOR CONSIDERATION/COMMENT
3. To site facility components in airsheds that have atmospheric dispersion characteristics which will protect air quality and aquatic and terrestrial ecosystems.	° restraints to dispersion	° site vicinity	° second level of protection concern
	° existing and anticipated air quality	° site vicinity	° major public concern
	° risks from direct inhalation of emissions - acute	° air dispersion zones	° risk factor includes indicator for topographic features on or around site
	° risks from direct inhalation of emissions - chronic		
4. To site facility components in settings which minimize the hazards to the site as a result of such conditions as flooding, potential susceptibility to seismic disturbance, slope failure and to utilize engineering measures where required to ensure maximum environmental safety.	° susceptibility of site to flooding	° site	° second level of protection
	° capability of providing natural containment	° site	° major public concern ° engineering and mitigation measures addressed ° geotechnical considerations were used in engineering and design work
5. To site facility components in settings which facilitate environmental monitoring as well as the application of counter measures, including backup emergency services.			° environmental monitoring and emergency services are assumed to be provided for the preferred siting option
6. To site facility components to minimize potential contamination of food chains.	° risks from consumption of crops and livestock	° air dispersion zones	° second level of protection concern ° major public concern

TABLE B.4

Relationship of Site Selection Objectives to the Phase 4A Factors Used in Comparing Siting Options

OWMC GOALS AND OBJECTIVES	RELATED FACTORS	STUDY AREA(S)	REASONS FOR CONSIDERATION/COMMENT
7. To site facility components to minimize hazards to the site from other uses which might contribute to the likelihood or severity of a release of contaminants.	° existing and anticipated air quality	° site vicinity	° second level of protection concern
	° restraints to dispersion	° site vicinity	° assesses incremental effect of OWMC facility on air quality
8. To locate discharge locations (if required) with dispersion characteristics that will protect human health, surface water resources and aquatic ecosystems.	° no specific factors		° assessed in supplementary engineering studies
B. Site - human exposure			
1. To site facility components to minimize the number of people who might be exposed as well as the duration of their exposure to contaminants in the event of a release.	° risk from direct inhalation of emissions - chronic ° risk from direct inhalation of emissions - acute	° air dispersion zones	° OWMC policies for emergency response capability and evacuation - assume minimized exposure for all sites
2. To site facility components to minimize the potential for the contamination of existing wells and other sources of water for human or animal consumption.	° ground water use	° site vicinity	all three factors incorporate:
	° potential for surface water use interference	° site vicinity	° second level of protection
	° risks from ingestion of cistern and pond water	° air dispersion zones	° major public concern

TABLE B.4

Relationship of Site Selection Objectives to the Phase 4A Factors Used in Comparing Siting Options

OWMC GOALS AND OBJECTIVES	RELATED FACTORS	STUDY AREA(S)	REASONS FOR CONSIDERATION/COMMENT
3. To site facility components to minimize the potential for exposure of populations who are sensitive to exposure and/or are difficult to evacuate.	° risk from direct inhalation - acute	° air dispersion zones	for both factors: ° second level of protection
	° risk from direct inhalation - chronic	° air dispersion zones	° major public concern ° both factors include indicators for numbers of existing and future residents
C. Transportation and Discharge - pathways into the environment			
1. To select transportation routes and modes which minimize the likelihood of a release of contaminants during transit.	° see Chapter 4.0, Volume I, Access Road Options	° local and regional access routes	
2. To site facility components such that the physical settings along the access routes to the site(s) naturally restrict the movement of contaminants and protect human health, terrestrial and aquatic ecosystems.	° transportation risks on local and regional access roads due to hazard-based spills of OWMC-generated transport	° local and regional access roads	° second level of protection ° includes indicators for risk to surface water along access routes and hydrogeologic sensitive land
D. Transportation and Discharge - human exposure			
1. To site facility components to minimize the number of people who might be exposed and the duration of that exposure to contaminants along access routes to the site(s) in the event of a release.	° transportation risks on local and regional access roads due to accident involvements of OWMC-generated transport	° local and regional access roads	for both factors: ° major public concern ° second level of protection

TABLE B.4

Relationship of Site Selection Objectives to the

Phase 4A Factors Used in Comparing Siting Options

OWMC GOALS AND OBJECTIVES	RELATED FACTORS	STUDY AREA(S)	REASONS FOR CONSIDERATION/COMMENT
	° transportation risks on local and regional access roads due to hazard-based spills of OWMC-generated transport	° local and regional access roads	° indicators measure risk to receptors due to accidents and spills (receptors are residents, community and recreation features, road users, surface water suitability and hydrogeologic sensitive lands)
	° annual province-wide hazard-based spill index of OWMC-generated transport	° province-wide access roads	for both factors:
	° annual province-wide accident involvements of OWMC-generated transport	° province-wide access roads	° major public concern ° provides second level of protection ° goal is to minimize risk of accidents and spills on total system
2. To site facility components to minimize the potential for exposure of populations who are sensitive to exposure and/or are difficult to evacuate along access routes to the site(s).	° transportation risks on local and regional access roads due to hazard-based spills of OWMC-generated traffic	° local and regional access roads	° major public concern ° second level of protection ° includes indicator for sensitive community and recreation features ° characteristics of residents also used in assessment of impacts along access routes

TABLE B.4

Relationship of Site Selection Objectives to the Phase 4A Factors Used in Comparing Siting Options

OWMC GOALS AND OBJECTIVES	RELATED FACTORS	STUDY AREA(S)	REASONS FOR CONSIDERATION/COMMENT
II **GOAL**			
To select a site(s) which minimizes environmental impact.			
Objectives			
A. **Physical and Biological**			
1. To avoid destruction and minimize disruption of significant natural ecosystems and to avoid destruction and minimize disruption of significant vegetation or wildlife populations.	° natural vegetation displaced	° site	° public and agency concern
	° significant environmental units	° site vicinity	° could result in permanent resource loss
	° other natural vegetation	° site vicinity	
	° fish and wildlife features of significance	° site vicinity	
	° fish communities	° access roads	
	° rare species	° site, site vicinity	
	° potential for occurrence of other significant features	° site	
2. To avoid destruction and minimize disruption of rare or uncommon species of plant and animal life.	° natural vegetation displaced	° site	° public and agency concern
	° significant environmental units	° site vicinity	° could result in permanent resource loss
	° other natural vegetation	° site vicinity	
	° fish and wildlife features of significance	° site vicinity	
	° fish communities	° access roads	
	° rare species	° site, site vicinity	
	° potential for occurrence of other significant features	° site	

TABLE B.4

Relationship of Site Selection Objectives to the

Phase 4A Factors Used in Comparing Siting Options

OWMC GOALS AND OBJECTIVES	RELATED FACTORS	STUDY AREA(S)	REASONS FOR CONSIDERATION/COMMENT
3. To avoid destruction and minimize disruption to significant landforms and other physical features.	° significant environmental units	° site vicinity	° public and agency concern
4. To minimize physical impacts on surface water such as sedimentation and changes in base flow.	° susceptibility to flooding	° site	° natural environment factors also consider effects of operations on aquatic habitat
5. To minimize impacts on surface water quality from emissions.	° risk from ingestion of cistern and pond water	° air dispersion zones	° includes analysis of number of cisterns and ponds in dispersion zones and use ° included as a risk factor because of link to human health
B. Resources			
1. To minimize the amount of land required to safely construct and operate the facility component(s).	° site area	° site	° parcel options chosen to minimize land required for facility (LF-1E, PI-1N, LF-3C) ° consideration given to site size in engineering and operations design
2. To minimize displacement of prime agricultural soils.	° loss of farmland	° site	° major public and agency concern ° includes consideration of soil capability class

TABLE B.4

Relationship of Site Selection Objectives to the

Phase 4A Factors Used in Comparing Siting Options

OWMC GOALS AND OBJECTIVES	RELATED FACTORS	STUDY AREA(S)	REASONS FOR CONSIDERATION/COMMENT
3. To minimize displacement and disruption of existing farm enterprises.	° displacement of farms with on-site headquarters	° site	° major public concern
	° partial displacement of farms	° site vicinity	
	° disruption to crop and livestock production	° access roads	
	° disruption to farm traffic and cattle crossings	° access roads	
	° disruption of adjacent farm operations	° site vicinity	
	° disruption of non-adjacent vicinity operations	° site vicinity	
4. To minimize disruption to productive agricultural areas and to stable agricultural communities.	° stability of farm population	° community and region	° major public and agency concern
	° stability of agricultural land base	° community and region	
	° disruption to the farm economy	° community and region	
5. To minimize displacement and disruption to other natural resource uses such as mineral aggregates.	° existing land uses	° site, site vicinity, community and region, access roads	° contacts with public officials and agencies provided input

TABLE B.4

Relationship of Site Selection Objectives to the

Phase 4A Factors Used in Comparing Siting Options

OWMC GOALS AND OBJECTIVES	RELATED FACTORS	STUDY AREA(S)	REASONS FOR CONSIDERATION/COMMENT
6. To minimize disruption of economically and/or recreationally important biological resources.			° agency and public inputs were received with regard to all factors to ensure that all significant uses and resources were included in the evaluation ° biological resource use was investigated but no significant uses were found (GLAL, 1985a)
7. To minimize displacement of and disruption to heritage and archaeological resources.	° archaeological resources	° site	° mitigation of impacts also considered
	° displacement of historical community and recreation features	° site	° heritage resources are considered as community and recreation features
	° disruption of operations of community and recreation features	° site vicinity, access roads	
8. To minimize displacement of areas with a high potential for resource development.	° proposed and planned land use	° site	° major public and agency concern ° contacts with municipalities and agencies provided input to all factors and were used to identify areas of concern

TABLE B.4

Relationship of Site Selection Objectives to the Phase 4A Factors Used in Comparing Siting Options

OWMC GOALS AND OBJECTIVES	RELATED FACTORS	STUDY AREA(S)	REASONS FOR CONSIDERATION/COMMENT
C. Land Uses and Land Ownership			
1. To minimize conflict with existing, committed, proposed and planned land uses.	° existing land use	° site, site vicinity, community and region, access roads	° public concern
	° proposed and planned land use	° site, site vicinity, community and region, access roads	
	° land use stability	° site, site vicinity	
2. To maximize the potential for the establishment of the facility components in locations characterized by similar industrial uses.	° existing land use	° site, site vicinity	° public concern
3. To minimize the amount of private property required and the disruption to land ownership patterns.	° displacement of residents	° site	° objective considered during siting option refinement and comparison
	° displacement of existing businesses	° site	
	° displacement of farms with on-site headquarters	° site	

TABLE B.4

Relationship of Site Selection Objectives to the

Phase 4A Factors Used in Comparing Siting Options

OWMC GOALS AND OBJECTIVES	RELATED FACTORS	STUDY AREA(S)	REASONS FOR CONSIDERATION/COMMENT
4. To minimize conflict with federal, provincial, municipal and native communities, policies, programs and plans.	° provincial policies and plans	° community and region, site vicinity	° conflict with airport also considered in stack height and location, site boundary decisions ° facility development will conform with all relevant government regulations
	° proposed and planned land uses	° site, site vicinity, community and region, access roads	° input sought from public agencies regarding decisions
D. Social			
1. To minimize the displacement of people, particularly those groups and individuals vulnerable to change.	° displacement of residents	° site	° includes analysis of characteristics of residents
2. To minimize conflict between the facility components, operations and the use and enjoyment of properties in the vicinity of the site(s), as result of visual intrusion, noise, etc.	° disruption of day-to-day activities and/or use and enjoyment of property	° site vicinity (adjacent and non-adjacent), access roads	° impacts from noise, odours, visual intrusion, truck traffic considered

TABLE B.4

Relationship of Site Selection Objectives to the Phase 4A Factors Used in Comparing Siting Options

OWMC GOALS AND OBJECTIVES	RELATED FACTORS	STUDY AREA(S)	REASONS FOR CONSIDERATION/COMMENT
3. To minimize losses or impacts on buildings and features of archaeological, historical, symbolic, cultural or social significance.	° disruption of operations of community and recreation features	° site vicinity (adjacent and non-adjacent), access roads	° mitigation considered for all factors
	° displacement of community, historical and recreation features	° site	° includes displacement of historical resources
	° archaeological resources	° site, site vicinity	
4. To maximize compatibility between the facility components and the character, image, traditions and lifestyle of the affected area.	° social stability	° community and region	all factors:
	° social cohesion		° perceived impacts included
	° community character		° public concern
5. To establish the facility components, to the extent possible, in areas in which the local communities can adapt to the type of changes which might result from the project.	° social stability	° community and region	
	° social cohesion	° community and region	
	° community character/image	° community and region	
	° municipal service and financial impacts	° community and region	

TABLE B.4

Relationship of Site Selection Objectives to the

Phase 4A Factors Used in Comparing Siting Options

OWMC GOALS AND OBJECTIVES	RELATED FACTORS	STUDY AREA(S)	REASONS FOR CONSIDERATION/COMMENT
6. To maximize community acceptance of the facility components.	° social stability ° community character ° social cohesion	° community and region	° public input provided ° land use compatibility part of consideration of existing and future land uses
7. To maximize compatibility with the visual character and appearance of the landscape in the vicinity of the facility components.	° community character	° community and region	° includes indicator for visual compatibility
	° disruption of day-to-day activities and/or use and enjoyment of property (non-adjacent)	° site vicinity	° includes indicator for visual intrusion
8. To minimize conflict between the transportation of hazardous wastes to the facility components and the use and enjoyment of properties along access routes to the site(s).	° disruption of day-to-day activities and/or the use and enjoyment of property (adjacent, vicinity)	° access roads	° impacts from noise and truck traffic considered
9. To minimize conflict between facility-related traffic and local traffic by ensuring that access routes provide an acceptable level of service.	° none specifically related		° OWMC policy to upgrade roads to regional road geometric and/or structural standard assumed
E. Economics			
1. To maximize local employment opportunities.	° none specifically related		° OWMC policy to maximize local employment opportunities assumed

TABLE B.4

Relationship of Site Selection Objectives to the Phase 4A Factors Used in Comparing Siting Options

OWMC GOALS AND OBJECTIVES	RELATED FACTORS	STUDY AREA(S)	REASONS FOR CONSIDERATION/COMMENT
2. To minimize the displacement of businesses.	° displacement of businesses	° site	
3. To minimize property value depreciation.	° property value impacts	° site vicinity	° assesses potential for property devaluation around candidate sites
4. To minimize disruption to the operations of local businesses.	° business activities negatively affected by OWMC's presence	° site vicinity	
	° business activities positively affected by OWMC's presence	° site vicinity	
	° tourism operations	° community and region	
5. To maximize compatibility with the local and regional economic character of the affected area.	° regional and community economic base	° community and region	° assesses effects on employment, income, investment, tourism
	° tourism economy		
	° disruption to farm economy		
6. To minimize adverse effects upon the provision and use of public and private community services and facilities.	° displacement of community and recreation features	° site	

TABLE B.4

Relationship of Site Selection Objectives to the Phase 4A Factors Used in Comparing Siting Options

OWMC GOALS AND OBJECTIVES	RELATED FACTORS	STUDY AREA(S)	REASONS FOR CONSIDERATION/COMMENT
	° disruption of operations of community and recreation features	° site vicinity adjacent and non-adjacent) access roads (adjacent and non-adjacent)	
III GOAL			
To minimize financial costs to OWMC.			
Objectives			
A. To hold financial costs to the lowest level consistent with the other goals of the site selection process			
1. To minimize approvals costs.			° OWMC policy area
2. To minimize site acquisition costs.	° capital costs	° site	° minimizing costs was considered as least important goal in site selection
3. To minimize on-site development costs, e.g., clearing, drainage, grading, screening and other engineering modifications.	° capital costs	° site	

TABLE B.4

Relationship of Site Selection Objectives to the Phase 4A Factors Used in Comparing Siting Options

OWMC GOALS AND OBJECTIVES	RELATED FACTORS	STUDY AREA(S)	REASONS FOR CONSIDERATION/COMMENT
4. To minimize off-site development costs, e.g., service extensions, road improvements.	° capital costs	° site vicinity, access routes	
5. To minimize development and/or operations costs associated with the construction and operations of the facility component(s), e.g., duplicate facilities.	° operating costs	° site, access routes	° part of consideration of placement of phys/chem treatment plant
6. To minimize development and/or operations costs necessitated by site or area characteristics, e.g., special remedial or monitoring measures to protect human health and the environment.	° operating costs	° site, access routes	
7. To minimize on and off-site development and/or operations costs associated with effluent dispersion, if any, e.g., pipelines.	° none specifically related		° supplementary sensitivity analysis conducted
8. To minimize transportation operations costs associated with hauling hazardous wastes to and among facility components.	° operating costs		

TABLE B.5

Change in Preliminary Factors/Indicators

Risk Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
A. RISK	A. RISK				
TRANSPORTATION	TRANSPORTATION				
1. Accident probability and safety of all vehicles accessing the OWMC facility (along entire access system)	1. Annual province-wide accident involvements of OWMC generated transport			x	° original factor for risk due to accidents was split into two factors representing two study areas; one for the local and regional roads (route from freeway to site) and one for the province-wide system (excludes routes between freeway and site)
° number of accidents per year	° annual number of vehicles involved in accidents	x			° it was more precise to estimate the number of OWMC generated vehicles involved in accidents, rather than to estimate accident event occurrence
	2. Transportation risks on local and regional access roads due to accident involvements of OWMC generated transport			x	° see above; original factor for risk due to accidents was split into two factors, representing two study areas
	° road user risk due to accident involvements		x		° new indicator developed to represent potential risk to road users due to accident involvements
° number of public intersections		x			° this indicator was applied to the access route selection and modified to represent the number of intersections where a turn occurs
° peak hour volume to capacity ratio		x			° applied in access route selection

* "Screened" refers to removal of the factor or indicator from the analysis.

TABLE B.5

Change in Preliminary Factors/Indicators

Risk Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
TRANSPORTATION (Cont'd)					
° number of level road crossings by type		x			° applied in access road and rail option selection stage
2. Probability of spills from vehicles carrying special waste to the OWMC facility	3. Annual province-wide hazard-based spill index of OWMC generated transport			x	° the original factor for risk due to spills was also split into two factors; one for local and regional roads and one for the province-wide system
° annual number of special waste spills as a consequence of a motor vehicle accident	° spill index due to motor vehicle accident involvements			x	° hazard-based spill index provides a more comprehensive consideration of the relative hazards of different materials
° annual number of in-transit special waste spills non-accident related	° spill index due to non-motor vehicle accident events			x	° hazard-based spill index provides a more comprehensive consideration since it considers the relative hazard of the spilled material
	4. Transportation risks on local and regional access roads due to hazard-based spills of OWMC generated transport			x	° risk to receptors (such as residents, community and recreation features) along access routes considered by this factor
	° road user risk index associated with hazard-based spill index			x	

TABLE B.5

Change in Preliminary Factors/Indicators

Risk Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
TRANSPORTATION (Cont'd)					
3. **Number and characteristics of people along access routes**	° population risk index associated with hazard-based spill index			x	° risk to population is considered by this indicator
• number and size of population concentrations				x	
• number and characteristics of populations using community facilities/ sensitive uses	° sensitive community and recreation features risk index associated with hazard-based spill index			x	° risk to users of sensitive community and recreation features is considered by this indicator
4. **Surface water suitability**	° surface water suitability			x	° the concern with regard to surface water is the potential for spills resulting in waste entry to a stream. This concern is now addressed by an indicator for surface water suitability for local and regional access routes
• downstream surface water use					
• length of access route at high risk of waste entry to a stream in event of a transportation accident					° the spill probability data is combined with data regarding surface water

TABLE B.5

Change in Preliminary Factors/Indicators

Risk Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
TRANSPORTATION (Cont'd)					
5. Hydrogeologic suitability ° distance through hydrogeologically sensitive lands	° hydrogeologic sensitive land risk index associated with hazard-based spill index			x	° as for surface water suitability, the risk to hydrogeologic sensitive lands is assessed as an indicator for risk on local and regional access roads
6. Transportation explosion		x			° potentially exposed area is contained within that assessed for spills and accidents ° screened to avoid double counting
AIR DISPERSION/AIR QUALITY	AIR RESOURCES (Impact Factors)				° air quality factors are now considered under both risk and impact factor groupings ° changes to air resources are considered as impact factors and effects of air quality changes on human health are considered under the risk factor grouping
1. Restraints to dispersion	1. Restraints to dispersion				° no change
° potential modifications to local climatic conditions	° local modifications to dispersion climatology				° wording change

TABLE B.5

Change in Preliminary Factors/Indicators

Risk Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
AIR DISPERSION/AIR QUALITY (Cont'd)					
° topographic features on or around site (e.g. river, valleys, depressions, significant slopes)		x			° topographic features not expected to have significant effect ° considered for acute emission factors - see below
° tall buildings		x			° effect is not significant
2. Existing and anticipated air quality	2. Existing and anticipated air quality				° no change
° estimated changes due to incinerator stack emissions compared to provincial air quality criteria	° existing air quality		x		° indicators added to more specifically measure changes in air quality
	° existing short-term air quality		x		° see above
	° estimated effect on air quality - incinerator stack emissions		x		° see above
° estimated changes to fugitive emissions	° estimated effect on air quality - fugitive emissions			x	° change in wording to clarify meaning

TABLE B.5

Change in Preliminary Factors/Indicators

Risk Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFICATION	COMMENTS
AIR DISPERSION/AIR QUALITY (Cont'd)	AIR QUALITY (Risk Factors)				
3. Number and characteristics of people in study area	1. Risks from direct inhalation of emissions - chronic			x	° factors expanded to better reflect potential sources and characteristics of risk
° existing population levels	° relative population exposure - incinerator stack emissions		x		° reorganization of indicators ° each indicator reflects potential pathway of long-term emissions to man through inhalation
	° relative population exposure - fugitive emissions		x		° see above
° future population	° relative future population exposure - incinerator stack emissions		x		° see above
	° relative future population exposure - fugitive emissions		x		° see above
	2. Risks from direct inhalation of emissions - acute		x		° see above

TABLE B.5

Change in Preliminary Factors/Indicators

Risk Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
AIR DISPERSION/AIR QUALITY (Cont'd)					
	° relative population exposure - upset emissions from incinerator stack		x		° reorganization of indicators ° each indicator reflects potential pathway of short-term emissions to man through inhalation
	° relative population exposure - upset emissions from low elevation sources		x		° see above
	° relative future population exposure - upset emissions from incinerator stack		x		° see above
	° relative future population exposure - upset emissions from low elevation sources		x		° see above
• number and characteristics of population using community facilities	° distribution of community facilities			x	° accurate data on facility use could not be obtained and not required for Phase 4A analysis
	° topographic features on/or around site		x		° relates to dispersion of low level, accidental emissions

TABLE B.5

Change in Preliminary Factors/Indicators

Risk Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFICATION	COMMENTS
AIR DISPERSION/AIR QUALITY (Cont'd)					
° number and characteristics of population using cisterns	3. Risks from ingestion of cistern and pond water		x		° wording change ° entire factor now covers cistern and pond use
	° relative exposure from cistern and pond water - incinerator stack emissions			x	° indicators reorganized ° each indicator reflects potential pathways of long-term emissions to man through inhalation
	° relative exposure from cistern and pond waters - fugitive emissions			x	° see above
4. Sensitive crops and livestock	4. Risk from consumption of crops and livestock			x	° wording change
° relative sensitive crop exposure	° relative sensitive crop exposure - incinerator stack emissions			x	° provides specific information regarding potential risk to existing and future populations consuming crops and livestock products exposed to stack and fugitive emissions
	° relative sensitive crop exposure - fugitive emissions			x	° see above
	° relative future sensitive crop exposure - incinerator stack emissions			x	° see above

TABLE B.5

Change in Preliminary Factors/Indicators

Risk Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
AIR DISPERSION/AIR QUALITY (Cont'd)					
	° relative future sensitive crop exposure - fugitive emissions			x	° see above
° relative sensitive livestock exposure	° relative sensitive livestock exposure - incinerator stack emissions			x	° see above
	° relative sensitive livestock exposure - fugitive emissions			x	° see above
	° relative future sensitive livestock exposure - incinerator stack emissions		x		° see above
	° relative future sensitive livestock exposure - fugitive emissions		x		° see above
HYDROGEOLOGIC SUITABILITY	HYDROGEOLOGIC SUITABILITY (Risk Factors)				
1. Natural containment	1. Capability of providing natural containment				° no change

TABLE B.5

Change in Preliminary Factors/Indicators

Risk Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
HYDROGEOLOGIC SUITABILITY (Cont'd)					
° predictability of geologic condition	° predictability of geologic condition				° no change
° breakthrough time	° contaminant breakthrough time				° wording change
° other contaminant pathways		x			° potential pathways, such as manmade structures (waterwells), were identified at all candidate sites and as such, this could not be applied to differentiate among siting options
2. Ground water use	2. Ground water use				° no change
° available dilution in aquifer		x			° information on thickness, permeability and hydraulic gradient in the underlying aquifer which is needed for assessing available dilution in the aquifer, is currently not available ° indicator not required for Phase 4A siting option comparison
° availability of alternate ground water supply	° availability of alternate ground water supplies				° no change
° existing and potential ground water use	° existing ground water use and potential demand				° wording change

TABLE B.5

Change in Preliminary Factors/Indicators

Risk Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFICATION	COMMENTS
SURFACE WATER SUITABILITY	SURFACE WATER SUITABILITY (Risk Factors)				
1. Susceptibility to flooding	1. Susceptibility of site to flooding				° wording change
° designated floodplains and flood prone areas	° designated floodplains and flood prone areas				° no change
° runoff potential	° runoff potential				° no change
° conveyance capacity	° conveyance capacity				° no change
2. Surface water use	2. Potential for water use interference				° wording change
° existing downstream surface water uses	° downstream water use index			x	° early indicator was split into two new indicators
	° number of local stream takings for potable supply			x	° see above

TABLE B.6

Change in Preliminary Factors/Indicators

Impact Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI- CATION	COMMENTS
B. ENVIRONMENTAL IMPACTS	B. ENVIRONMENTAL IMPACTS				
RESIDENTS	RESIDENTS				
1. Displacement of residents	1. Displacement of residents (site)				° no change
• number of people	° number of residents displaced				° wording change
• adaptability of people	° characteristics of residents displaced			x	° no change in data attached to indicator, but "characteristics of residents" better describes the indicator
• attachment to place	° attachment to place of residents displaced				° wording change
2. Displacement of residents (access roads)		x			° information received on the extent of road widenings along potential access routes confirmed that no resident displacement would occur
3. Economic stability of residents	2. Property value impacts (site vicinity)				° wording change to more accurately reflect factor measure
• change in property values	° potential for change in property values within 1,500 m zone				° wording change

TABLE B.6

Change in Preliminary Factors/Indicators

Impact Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
RESIDENTS (Cont'd)					
4. Use and enjoyment of property and day-to-day activities	3. Disruption of day-to-day activities and/or use and enjoyment of property (adjacent to site)		x		° factors and indicators (modified numbers 3 - 6) have been refined to reflect residents within potential impact zones (e.g. noise, visual exposure) for each study area
° number and characteristics of residents	° number of residents adjacent to site and spending most time on property		x		° characteristics as gathered through resident interviews have been used to determine those residents likely to experience more severe impacts due to longer time spent on property
° number and kinds of property uses and residents' activities		x			° no significant differences in responses across communities surveyed so that data not useful in comparison of siting options
	° number of residents adjacent to site		x		° provides additional measure of disruption to residents
	4. Disruption of day-to-day activities and/or use and enjoyment of property (site vicinity)		x		° factors and indicators have been refined to reflect residents within potential impact zones (e.g. noise, visual exposure) for each study area
	° number of residents spending most time on properties within noise impact zone (55 dBA)		x		° see above

TABLE B.6

Change in Preliminary Factors/Indicators

Impact Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
RESIDENTS (Cont'd)					
	° number of residents within noise impact zone		x		° see above
° potential visual exposure of residents	° visual intrusion		x		° see above
	° number of residents within site vicinity		x		° see above
	° number and characteristics of residents likely to be affected by facility night lighting and changes in level of odour (site, site vicinity)	x			° precise impact zones for odour and facility night lighting could not be determined at this time
	° number and kinds of activities or uses of property likely to be affected by facility night lighting and changes in level of odour (site, site vicinity)	x			° see above

TABLE B.6

Change in Preliminary Factors/Indicators

Impact Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
RESIDENTS (Cont'd)					
	° resident perception of compatibility of facility with their daily activities and use and enjoyment of property (site, site vicinity)	x			° data gathered were similar across all sites and therefore not useful for comparison
	5. Disruption of day-to-day activities and/or use and enjoyment of property (adjacent to access roads)		x		° factors and indicators have been refined to reflect residents within potential impact zones
	° characteristics of residents		x		° see above
	° number of residents adjacent to access roads		x		° see above
	6. Disruption of day-to-day activities and/or use and enjoyment of property (access road vicinity)		x		° factors and indicators have been refined to reflect residents within potential impact zones
	° number of residents within noise impact zone		x		° see above

TABLE B.6

Change in Preliminary Factors/Indicators

Impact Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
RESIDENTS (Cont'd)					
	° number of residents within access road vicinity		x		° see above
° residents' perception of compatibility with daily activities and use of property		x			° no significant differences in responses from communities surveyed so that data not useful in comparison of siting options
° number and characteristics of residents likely to be affected by truck movements		x			° time constraints did not permit for the carrying out of the necessary field work (survey) to determine resident characteristics. The number of residents was estimated
° number and kinds of activities or uses of property likely to be affected by facility operations		x			° time constraints did not permit for contacts to gather the required level of data
BUSINESSES	**BUSINESSES**				
1. Displacement of existing commercial and industrial uses	1. Displacement of businesses				° no change
° number of businesses	° number and characteristics of businesses displaced			x	° preliminary indicators combined into one indicator

TABLE B.6

Change in Preliminary Factors/Indicators

Impact Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
BUSINESSES (Cont'd)					
° characteristics of businesses displaced					
2. Operations of commercial and industrial businesses	2. Business activities negatively affected by the presence of OWMC facilities			x	° factor now split into two to assess differences between businesses positively and negatively affected
° number and characteristics of businesses ° effect on business operations	° number and characteristics of businesses negatively affected by OWMC's presence			x	° effect on businesses negatively affected considered under this revised indicator
	3. Business activities positively affected by the presence of OWMC facilities			x	° factor now split into two to assess differences between businesses positively and negatively affected
	° number and characteristics of businesses positively affected by OWMC's presence			x	° effect on businesses positively affected considered under this revised indicator
	4. Tourism operations (community and region)		x		° new factor added to assess impacts on tourist operations specifically in response to public concern

TABLE B.6

Change in Preliminary Factors/Indicators

Impact Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
BUSINESSES (Cont'd)					
	° reduction in tourism visitation/occupancy rates		×		° see above
	° presence of nuisance impacts		×		° see above
	° impacts related to tourism related special views		×		° see above
	° visual exposure of passing tourist traffic to site		×		° see above
COMMUNITY FACILITIES AND SERVICES					
1. Public and private community and recreation facilities displaced	1. Displacement of historical, community and recreation features (site)			×	° historic features added to analysis ° screening of potential sites in Phase 3B considerably reduced the extent of possible feature displacement. This factor was operationalized, but subsequently screened from the analysis since the characteristics of those features remaining on-site are such that displacement impacts can be mitigated

TABLE B.6

Change in Preliminary Factors/Indicators

Impact Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
COMMUNITY FACILITIES AND SERVICES (Cont'd)					
° number and characteristics of community facilities and services	° number of features displaced			x	° original indicator split into two to assess number and significance of features
	° number of significant features displaced				° see above
° availability and capacity of alternative services/facilities		x			° data not gathered because capacity and alternatives not an issue with facilities found
2. Displacement of historical, community and recreation features (access roads)					
° number and characteristics of existing and proposed community and recreation features displaced		x			° information received on the extent of road widenings along potential access routes confirmed that no feature displacement would occur
° availability and capacity of alternate services/facilities		x			° because no features would be displaced, information on alternatives was not gathered

TABLE B.6

Change in Preliminary Factors/Indicators

Impact Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
COMMUNITY FACILITIES AND SERVICES (Cont'd)					
° change in the use of existing community and recreation features (site, access roads)		x			° displaced users of community and recreation features could not be identified from data gathered through resident interviews. In addition, the actual extent of out-migration is an unknown variable since it will be based on voluntary decisions by users in relation to facility siting. It is also anticipated that construction workers will commute to the site and that the number of households associated with operations employment that will locate in the host municipality will not significantly affect demand for facilities and services
° perceived disruptive effects of the facility on community and recreation features (site, access roads)		x			° operators' comments/concerns were similar and general in nature and therefore, not useful for comparison
3. Operations of public and private community services and facilities	2. Disruption of operations of community and recreation features (adjacent to site/access roads)				° wording change
° number and characteristics of services and facilities	° number of sensitive features adjacent to site/access roads		x		° factor and indicators have been expanded to reflect characteristics of features within various impact zones

TABLE B.6

Change in Preliminary Factors/Indicators

Impact Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
COMMUNITY FACILITIES AND SERVICES (Cont'd)					
	° number of features adjacent to site/access roads		x		° see above
	3. Disruption of operations of community and recreation features (site vicinity, access road vicinity)		x		° see above
	° number of sensitive features within noise impact zone		x		° indicators have been refined to reflect characteristics of features with various impact zones
	° number of features within noise impact zone		x		° see above
	° number of sensitive features within site vicinity/access road vicinity		x		° see above
° number and characteristics of community and recreation features likely to be affected by changes in level of odour (adjacent to site, site vicinity)		x			° precise impact zones for odour could not be determined at this time

TABLE B.6

Change in Preliminary Factors/Indicators

Impact Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
COMMUNITY FACILITIES AND SERVICES (Cont'd)					
	° number of features within site vicinity/ access road vicinity		x		° indicators have been refined to reflect characteristics of features within various impact zones
° use of community facilities and services		x			° the actual extent of out-migration is an unknown variable since it will be based on voluntary decisions by users in relation to facility siting. It is also anticipated that construction workers will commute to the site and that the number of households associated with operations employment that will locate in the host municipality will not significantly affect demand for facility
° perceived effects of OWMC facility		x			° operators' comments/concerns were similar and general in nature and therefore not useful for comparison
4. Proposed and planned community and recreation facilities		x			° included under all displacement and disruption to community and recreation features factors
° number and type of proposed and planned community and recreational facilities		x			° included under all displacement and disruption to community and recreation features factors

TABLE B.6

Change in Preliminary Factors/Indicators

Impact Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
COMMUNITY AND REGIONAL					
1. Community stability	1. Social stability			x	° wording change to more accurately reflect factor meaning
° rate of population change in the community	° municipal growth 1971-1981			x	° wording change
° length of residence and type of household	° stability index**			x	° length of residence is a subindicator of the stability index
° number and characteristics of community organizations and activities that contribute to social stability	° disruption through resident displacement (on-site residents)			x	° original indicator data not collected; resident displacement added as indicator of effect on social stability
° commitment of residents	° disruption through out-migration (adjacent and vicinity residents)			x	° concern is with potential increased out-migration
° community aspirations or desired social changes		x			° Regional and Local Official Plan statements were too general in nature to be useful for comparison. Time constraints did not permit community leader interviews or review of other municipal documents

** stability index = % of households at current address more than 5 years + % of homeowners + % whose ancestors owned property + % whose ancestors lived in municipality

TABLE B.6

Change in Preliminary Factors/Indicators

Impact Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
COMMUNITY AND REGIONAL (Cont'd)					
2. Community cohesion	2. Social cohesion			x	° wording change to more accurately reflect meaning of factor
° neighbouring and social interaction	° disruption through resident displacement			x	° "neighbouring and social interaction" is a subindicator of indicators extent of disruption through resident displacement and out-migration
	° disruption through out-migration			x	° see above
° compatibility of existing residents and new employees		x			° such impacts unlikely to occur; extent of in-migration expected to be negligible
° extent of disruption of focal points for social interaction	° number of community features contributing to cohesion disrupted	x			° no such features were found to be displaced
° number and characteristics of existing and new residents		x			° it is anticipated that the number of households associated with operations employment that will locate in the host municipality will not be of such magnitude as to alter the existing social patterns
3. Satisfaction with the community (site, site vicinity)		x			° data gathered were similar across all sites and, therefore, not useful for comparison

TABLE B.6

Change in Preliminary Factors/Indicators

Impact Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
COMMUNITY AND REGIONAL (Cont'd)					
° perceived change in community features which contribute to residents' satisfaction with their community as a place to live		x			° see above
4. Community character/image	3. Community character				° wording change
° number and type of distinctive community features	° heritage features				° heritage features and landmarks are distinctive community features
° perceived compatibility of the facility with community character		x			° data gathered were similar across all sites and, therefore, not useful for comparison ° data not useful for comparison of siting options
° land use pattern and economic activity		x			° included in land use and economic base factors
	° compatibility with existing land use		x		° degree of existing and designated industrial land uses is indicative of current and future community character, respectively, and potential facility compatibility
	° visual compatibility		x		° degree of visual compatibility may affect image of community

TABLE B.6

Change in Preliminary Factors/Indicators

Impact Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
COMMUNITY AND REGIONAL (Cont'd)					
5. Economic base	4. Regional and community economic base				° wording change
° nature of economic base	° new regional jobs created		x		° original indicators refined to more specifically reflect impacts on economic base
° economic effects (income, employment, retail sales)	° additional households		x		° see above
	° potential for industrial spin-off	x			° forms part of new regional jobs created indicator
	° perceived impact on community economy		x		° see above
	5. Tourism economy				° new factor added to specifically address impacts on tourism in response to public concern
	° decline in tourist visitation and attendance		x		° see above
	° tourism-related development plans		x		° see above
	° future development potential		x		° see above

TABLE B.6

Change in Preliminary Factors/Indicators

Impact Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
COMMUNITY AND REGIONAL (Cont'd)					
6. Municipal service and financial impacts	6. Municipal finance				° wording change; municipal services impact is minor consideration
° municipal finance	° net financial impact on area municipality and net financial impact on regional municipality			x	° the original municipal finance indicator has been broken down into more specific measures of impact on municipal finance
	° net financial impact on area municipality tax rate			x	° see above
° municipal service levels					
° mill rates				x	° service impacts are considered as a subindicator for the municipal finance factor
7. Archaeological/historical resources				x	° mill rates now treated as a subindicator under the impact on tax rate indicator
° number of native archaeological features	7. Archaeological resources				° wording change only

TABLE B.6

Change in Preliminary Factors/Indicators

Impact Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
COMMUNITY AND REGIONAL (Cont'd)					
	° number of significant archaeological resources impacted			x	° number of native archaeological features and Euro-Canadian historic sites were combined, and features significant in site comparison were identified to provide adequate index of archaeologic impacts
° number of Euro-Canadian historic sites		x			
° areas of high archaeological potential		x			° previous indicators were of little value in comparing siting options because of general nature ° previous information too imprecise to be used in siting option comparison
LAND USE IMPACTS					
1. Provincial policies and plans	1. Provincial policies and plans (site vicinity, community and regional)				° no change
° Niagara Escarpment plan	° Niagara Escarpment plan				° no change
° Parkway Belt West plan	° Parkway Belt West plan				° no change
2. Existing land uses	2. Existing land uses (site, site vicinity, community and regional, access roads)				° no change

TABLE B.6

Change in Preliminary Factors/Indicators

Impact Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
LAND USE IMPACTS (Cont'd)					
° existing land use pattern	° existing land use pattern				° no change
° number of residences	° number of residences (site, site vicinity, access roads)				° no change
	° number of commercial facilities (access roads)			x	° number of commercial facilities only, used for access roads study ° insignificant data for industrial uses for access roads study area
° industrial and commercial facilities	° number of commercial and industrial facilities (site, site vicinity)			x	° no change
3. Proposed and planned land use	3. Proposed and planned land use				° no change
° land use designations	° land use designations (site, site vicinity, community and region, access roads)				° no change
° approved development proposals		x			° few occurrences

TABLE B.6

Change in Preliminary Factors/Indicators

Impact Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
LAND USE IMPACTS (Cont'd)					
° unapproved development proposals	° unapproved development proposals (access roads)				° no change ° few occurrences of this indicator for site, site vicinity study areas
° vacant lots of record	° vacant lots of record (site, site vicinity, access roads)				° no change
° local official plan policies	° local official plan policies (site, site vicinity, community and region, access roads)				° no change
° regional official plan policies	° regional official plan policies (site, site vicinity, community and region, access roads)				° no change
° local zoning by-laws	° local zoning by-laws (site, site vicinity)				° no change
4. Land use stability	4. Land use stability (site, site vicinity)				° no change
° land sales	° land sales				° no change
° development proposals		x			° no occurrences on-site; few impacts in site vicinity

TABLE B.6

Change in Preliminary Factors/Indicators

Impact Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
LAND USE IMPACTS (Cont'd)					
° absentee land ownership	° absentee land ownership				° no change
° trends in land value	° trends in land value (site vicinity only)				° no detailed sales data available for site study area
° building quality	° building quality				° no change
AGRICULTURAL RESOURCES					
1. Displacement of existing farm businesses and farm property	1. Displacement of farms with on-site headquarters			x	° wording change to more accurately reflect meaning of factor
° number and average size of farm businesses	° number of farms			x	° previous indicator split into two indicators
	° average size of farms			x	° see above
° tillable hectares		x			° redundant with "average farm size" indicator
	° estimated gross farm revenue		x		° indicates relative loss of revenue to community from dislocated farm businesses
2. Displacement of prime agricultural land	2. Loss of farmland				° no change

TABLE B.6

Change in Preliminary Factors/Indicators

Impact Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
AGRICULTURAL RESOURCES (Cont'd)					
• soil capability (including climate considerations)	° soil capability				° no change
• tile drainage	° tile drainage				° no change
• land losses due to road improvements		x			° differences among options were very minor
	Vicinity				
3. Operations of existing farm businesses	3. Partial displacement of farms (farms with off-site headquarters losing on-site land)			x	° factors and indicators expanded to provide a more detailed level of information by study area (see modified factors 3-5)
• number and average size of existing farm operations	° number of operations affected			x	° wording change
	° average parcel size			x	° more accurate assessment of degree of impact to farms losing land
• crop and livestock uses	° proportion of land base lost			x	° see above
	4. Disruption of adjacent farm operations			x	° factors and indicators expanded to provide a more detailed level of information by study area

TABLE B.6

Change in Preliminary Factors/Indicators

Impact Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
AGRICULTURAL RESOURCES (Cont'd)					
	° number of farms with headquarters			x	° wording change
	° number of operators with owned land		x		° gives more accurate assessment of relative potential for farm property value impacts
° crop and livestock density	° livestock density			x	° more accurate measure of livestock use for comparative purposes
	5. Disruption of non-adjacent farm operations			x	° factors and indicators expanded to provide a more detailed level of information by study area
	° number of farms with headquarters			x	° wording change
	° proportion of land in crops			x	° better describes extent to which the vicinity area is
	° livestock density			x	° more accurate measure of crop and livestock use for comparative purposes
	Access Roads				
3. Operations of existing farm businesses	6. Disruption to farm traffic and cattle crossings			x	° farm traffic and cattle crossings considered under new factor ° new factor added in response to public concern

TABLE B.6

Change in Preliminary Factors/Indicators

Impact Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
AGRICULTURAL RESOURCES (Cont'd)					
° farm-related traffic movements	° local roads			x	° see above
° frequency of cattle crossings	° regional roads			x	° see above
	7. Disruption to crop and livestock production		x		° provides additional measure of potential disruption
	° adjacent crops		x		° provides additional measure of potential disruption
	° adjacent livestock		x		° see above
	° downstream livestock		x		° see above
	Community and Region				
4. Agricultural community	8. Stability of farm population			x	° separates indicators from land base-related indicators and allows for differential weighting
° number and characteristics of farm families	° age of operators (% less than 55 years old)			x	° more specific measure of farm operator characteristics
	° number of full-time operators (% of total operators)			x	° more specific measure of farm operator characteristics

TABLE B.6

Change in Preliminary Factors/Indicators

Impact Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
AGRICULTURAL RESOURCES (Cont'd)					
• land fragmentation/ ownership	9. Stability of agricultural land base				° new factor measures stability of land base in greater detail
	° tenure			x	° new indicator provides added measure of ownership
	° farm residences (as percent of total residences)			x	° separates farm ownership from the above indicator
	° agriculturally designated land (as Class 1 equivalents)			x	° indicators for "planned and proposed land uses" grouped under more explicit factor to appropriate study area, i.e. "Community"
	° private land ownership			x	° new indicator provides more explicit information regarding future land use expectations
	10. Disruption to farm economy			x	° modified to specifically address concerns at a regional level
	° gross farm revenue			x	° indicates relative potential for impact to the regional agricultural economy
	° relative exposure of crop and livestock to stack emissions			x	° economic impacts assessed

TABLE B.6

Change in Preliminary Factors/Indicators

Impact Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
AGRICULTURAL RESOURCES (Cont'd)					
	° relative exposure of crop and livestock to fugitive emissions			x	° economic impacts assessed
	° relative exposure of downstream livestock to potential spills into streams			x	° economic impacts assessed
5. Planned and proposed agricultural uses				x	° factor now forms part of Land Use Factors
					° see also stability of farm population factor
° land use plans of public land owners				x	° see above
° land use designations and policies				x	° see above
NATURAL ENVIRONMENT					
1. Rare species	1. Rare species (site)			x	° factor has been modified to deal with plants and animals separately
° number of rare species	° number of rare plant species			x	° provides a basis for comparison of rare species

TABLE B.6

Change in Preliminary Factors/Indicators

Impact Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFICATION	COMMENTS
NATURAL ENVIRONMENT (Cont'd)					
° number of individuals of each rare species	° number of rare animal species			x	° see above
° on-site distribution				x	° distribution considered in above indicators
2. Fish and wildlife communities	2. Natural vegetation displaced (site)			x	° vegetation displacement factor added to replace habitat loss factor
° species lists		x			° not used for comparisons because quality and quantity of data varies among sites
° extent and types of aquatic habitat	° number of hectares of natural vegetation displaced			x	° vegetation displacement factor added as indicator of habitat loss
° extent and types of terrestrial wildlife habitats				x	° see above
	3. Fish and wildlife features of significance (site vicinity)			x	° factor modified to assess features in site vicinity specifically
	° number of significant features in site vicinity			x	° indicator modified from distance from site to feature to number of features because there is not necessarily a linear relationship between distance and impact
3. Natural vegetation communities	4. Other natural vegetation (site vicinity)			x	° factor incorporated into new factors; vegetation displaced and other natural vegetation

TABLE B.6

Change in Preliminary Factors/Indicators

Impact Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFICATION	COMMENTS
NATURAL ENVIRONMENT (Cont'd)					
	° areal extent of other natural vegetation			x	° see above
	° also see above factor 2 natural vegetation displaced			x	° see above
• species lists		x			° not useful for comparisons because quality and quantity of data varies among sites
• areal extent of natural vegetation patches				x	° incorporated into other natural vegetation factor and see above modified factor 2
• variety of natural vegetation cover types		x			° reduces overlap among vegetation and habitat-related indicators
• number and extent of special associations		x			° none occur
4. Biological resource use		x			° level of use is generally low across siting options
• forestry activity		x			° not a significant factor
• trapping activity		x			° see points above
• hunting activity		x			° see points above
• fishing activity		x			° see points above

TABLE B.6

Change in Preliminary Factors/Indicators

Impact Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
NATURAL ENVIRONMENT (Cont'd)					
5. Significant Environment Units (SEUs) in site vicinity	5. Significant Environment Units (SEUs) (site vicinity)				° no change
• distance from site to SEU	° areal extent of SEU			x	° there is not necessarily a linear relationship between distance and impact ° locations of significant features in SEUs are not always known ° area of SEU within site vicinity provides simple and adequate index for comparative evaluation
	6. Potential for occurrence of additional significant biological features (site)		x		° new factor added to assess on-site impact
	° level of potential for occurrence of significant features		x		° recognizes that the probability of finding additional significant features on certain sites is higher than on others
	7. Fish communities (access routes)		x		° transferred from surface water analysis factor grouping
	° spill pathway index		x		° relates to potential impacts on aquatic life
	° downstream length of regionally significant fishery		x		° see above

TABLE B.6

Change in Preliminary Factors/Indicators

Impact Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED*	ADDITION	MODIFI-CATION	COMMENTS
NATURAL ENVIRONMENT (Cont'd)					
	° downstream length of locally significant fishery		x		° see above

TABLE B.6

Change in Preliminary Factors/Indicators

Engineering Factors

PRELIMINARY PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	MODIFIED PHASE 4A FACTORS FACTOR GROUPING/FACTOR/INDICATOR	SCREENED	ADDITION	MODIFI-CATION	COMMENTS
C. **COST**	C. **ENGINEERING**				
1. Annualized cost • annualized cost per year	1. Capital cost • incineration • physical/chemical treatment • solidification • on-site facilities • engineered landfill • on-site facilities (site-specific) • off-site facilities (site-specific)		x		• the factor grouping "Cost" has been broken down into the capital and operating cost factors and their relevant indicators in order to better illustrate the site-specific cost differences between the siting combinations • revision made in response to a public concern
	2. Operating cost • fixed operating costs • variable operating costs • start-up costs • decommissioning costs • post-closure and long-term care		x		• see above
	3. Site area • site size • landfill life		x		• this new factor and associated indicators addresses rationale for accepting or rejecting a candidate site based on adequacy of site to accommodate the facility, including the 400-metre technical buffer zone, and/or landfill, including 50-metre buffer zone, and an approximately 20-year landfill life

TABLE B.7

Risk Factor Rankings by Consultant

DISCIPLINE/FACTOR	CONSULTANTS' RANKING (FINAL RANKING)[1]
Transportation (out of 10)	
° Transportation risks on local and regional access roads due to hazard-based spills of OWMC-generated transport	10 (10)
° Transportation risks on local and regional access roads due to accident involvements of OWMC-generated transport	10 (10)
° Annual province-wide hazard-based spill index of OWMC-generated transport	8 (8)
° Annual province-wide accident involvements of OWMC-generated traffic	8 (8)
Hydrogeology	
° Capability to provide natural containment	considered more important
° Ground water use	considered less important
Air Quality (out of 5)	
° Risk from direct inhalation of emissions - chronic	5 (9)
° Risk from direct inhalation of emissions - acute	3.7 (8)
° Risks from ingestion of cistern and pond water	3 (6)
° Risks from consumption of crops and livestock	2.5 (5)

[1] Final Ranking out of 10

TABLE B.7

Risk Factor Rankings by Consultant

DISCIPLINE/FACTOR	CONSULTANTS' RANKING (FINAL RANKING)
Surface Water	
° Potential for surface water use interference	more important (7)
° Susceptibility of site to flooding	less important (5)

INTRODUCTION TO TABLE B.8

Public Input to Changes in Factor Ranking

Table B.8 documents changes that were made to factor rankings based on public input. The following provides background information regarding the way in which public input provided through two OWMC workshops was used in ranking factors in Phase 4A.

Two public workshops were held by OWMC in the summer of 1985. Participants in the workshops included interested individuals, groups and organizations. A total of 74 people took part in the workshops.

Copies of Volumes 1 and 2 of the Background Materials for the Phase 4A Workshops were distributed prior to the workshops (OWMC, 1985). The participants were asked to review the preliminary risk and impact factor rankings prepared by the site selection consultants and to provide their input and response to these rankings.

The results of these workshops as well as any other input received from the public by individual consultants were reviewed and considered in the factor ranking process.

The participants at the OWMC workshops were asked to list the ten most important risk and impact factors and to assign a total of 100 points among those factors. Reasons for the point distribution were also requested for the three most highly ranked factors. In addition, small group working meetings were held to answer technical questions and to discuss factor rankings.

The outcome of these workshops was a separate factor ranking for risk and impact factors. The ranking was compiled by OWMC. The participants at the public workshops ranked risk factor groupings rather than individual risk factors. Table 1.1 lists the public ranking of factors based on percent of total points assigned. In addition, a higher ranking was assigned to risks for local and regional access roads versus the province-wide system. These rankings are based on percent of total point assigned and on discussions with individuals at the workshops (12.9% for provincial highways and 24.9% for local and regional access routes).

The results of the workshop indicated a ranking for general impact factor groupings. Table 1.1 lists the ranking based on percentage of total points assigned. In addition, the results of the workshops indicated that the impacts of displacement of residents and farms were as important as the disruption of residents and farming operations off-site. This preference was supported by the numerical factor ranking and by discussions with individuals. Table 1.2 contains the percent of total points assigned for displacement and disruption of residents and farms. The disruption of residents and farms were ranked more highly than the displacement of residents and farms, in part based on workshop inputs.

The actual point numbers resulting from the public workshops were not considered highly precise because of the large number of impact factors, the differences in the number of factors by discipline and the overlap between factor groupings.

TABLE 1.1

Summary of Public Workshop Results

Ranking of Factors

FACTOR GROUPING	RANK[1]	% TOTAL POINTS ASSIGNED
A. **RISK**		
° Transportation risk	1	31.6
° Ground water risk	2	24.7
° Stack and fugitive emissions - direct inhalation	3	13.5
° Stack and fugitive emissions - indirect exposure	3	13.4
° Acute events	4	9.6
° Surface water risk	5	6.1
B. **IMPACTS**		
° Residents	1	34.3
° Agricultural Resources	2	26.1
° Natural Environment (includes air quality and water quality impacts)	3	13.5
° Businesses	4	8.0
° Community and Regional (social and economic)	5	6.8
° Land Use	5	6.8
° Community and Recreation Features	6	2.9

Notes: 1 = most important
5 = least important

Table 1.2

Public Factor Ranking for Displacement and Disruption of Residents and Farms

FACTOR GROUP	% TOTAL POINTS ASSIGNED
° Residents disrupted (adjacent, site vicinity, access roads)	61.0
° Disruption of farm operations (adjacent, site vicinity and access roads)	39.7
° Displacement/partial displacement of farm	31.1
° Residents displaced	29.2

The results of the OWMC public workshops were incorporated into refinement of factor rankings by the site selection consultants. The results of the workshop attendee's ranking of factors were cross-checked against the consultants' factor rankings and the composite factor ranking produced by M.M. Dillon. Table B-9 in Appendix B documents the application of the criterion "public input" into risk factor ranking. The following Table B-8 lists changes that were made to the preliminary factor ranking based on public input.

The impact factor rankings of the workshop participants assisted in grouping factors in terms of high, medium and low importance. The impacts on residents and agricultural resources were considered of high importance based on the workshop results. Natural environment, businesses, community and regional and land use were considered to be of moderate importance. Community and recreation features were considered of low importance.

TABLE B.8

Public Input to Changes In Factor Ranking Levels

FACTOR	JUNE 1985[1]	FINAL RANK[2]	PUBLIC INPUT
IMPACT			
° Disruption of use and enjoyment of property and/or day-to-day activities (adjacent)	5	10	The following comments pertain to the seven factors listed in the left column:
° Disruption of residents	5	9	° impacts on residents considered as one of the most important factor groupings at public workshops
° Disruption of adjacent farm operations	5	10	
° Partial displacement of farms	5	9	° public input indicated that those residents left behind would be impacted to a greater extent than those displaced and should be given a higher weight
° Displacement of farms with on-site headquarters	4	6	
° Existing land use (site vicinity)	2	8	° rationale was that off-site disruption impacts may be long-term and not fully mitigable but on-site impacts are short-term and mitigation will reduce or remove impacts
° Existing land use (site)	modified	6	

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[1] Ranking presented in Background Material for OWMC Phase 4A Site Selection Workshops, Volume 2, June 1985. Rankings are from 1 to 5 (5 is most important).

[2] Ranking developed by the site selection coordinating consultant (M.M. Dillon) based upon the consultants' rankings for the purpose of comparing siting options. Rankings have been transformed to ten levels (1 to 10 with 10 being most important).

TABLE B.8

Public Input to Changes In Factor Ranking Levels

FACTOR	JUNE 1985[1]	FINAL RANK[2]	PUBLIC INPUT
IMPACT			
° Existing land use (site) - (Cont'd)	modified	6	° rankings for impacts on residents, farms and existing land use on and off-site were adjusted to reflect public input
° Disruption of use and enjoyment of property and/or day-to-day activities (non-adjacent)	2	9	° at the public workshops, disruption of residents off-site was ranked as one of the most important impact factor groupings and therefore the ranking was increased
° Disruption of non-adjacent farm operations	4	9	° at the public workshops, disruption of farm operations was a major public concern and therefore the ranking was increased
° Rare species (site)	5	8	° public workshop input indicated that the public is more concerned about species listed in the Endangered Species Act (which are not confirmed for any siting option),

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[1] Ranking presented in Background Material for OWMC Phase 4A Site Selection Workshops, Volume 2, June 1985. Rankings are from 1 to 5 (5 is most important).

[2] Ranking developed by the site selection coordinating consultant (M.M. Dillon) based upon the consultants' rankings for the purpose of comparing siting options. Rankings have been transformed to ten levels (1 to 10 with 10 being most important).

TABLE B.8

Public Input to Changes In Factor Ranking Levels

FACTOR	JUNE 1985[1]	FINAL RANK[2]	PUBLIC INPUT
IMPACT			
° Rare species (site) Cont'd			and that less significant occurrences were not of equal importance to other factors ranked as 5 by workshop participants; thus the rank was reduced ° change in this rank reduced the rank for "potential for occurrence of other significant biological features" which is considered to rank lower than rare species (from 4 in June to a final rank of 6)
° Social stability	4	8	° at the public workshops, the LF-3C resident group suggested that too much weight was being given to community and regional factors in comparison to impacts on residents because community and

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[1] Ranking presented in Background Material for OWMC Phase 4A Site Selection Workshops, Volume 2, June 1985. Rankings are from 1 to 5 (5 is most important).

[2] Ranking developed by the site selection coordinating consultant (M.M. Dillon) based upon the consultants' rankings for the purpose of comparing siting options. Rankings have been transformed to ten levels (1 to 10 with 10 being most important).

TABLE B.8

Public Input to Changes In Factor Ranking Levels

FACTOR	JUNE 1985[1]	FINAL RANK[2]	PUBLIC INPUT
IMPACT			
° Social stability - (Cont'd)	4	8	region factors are less precisely predictable and so warrant a much lower weight ° the community and region factors require prediction of the attitudes and behaviour of residents (which are influenced in part by the actions of OWMC) and thus are difficult to predict ° these impacts can only be defined with certainty after the fact. The weights assigned to community and regional factors were decreased by IER relative to the weights of disruption of daily activities (adjacent and vicinity residents) and displacement of residents which were adjusted upwards.

[1] Ranking presented in Background Material for OWMC Phase 4A Site Selection Workshops, Volume 2, June 1985. Rankings are from 1 to 5 (5 is most important).

[2] Ranking developed by the site selection coordinating consultant (M.M. Dillon) based upon the consultants' rankings for the purpose of comparing siting options. Rankings have been transformed to ten levels (1 to 10 with 10 being most important).

TABLE B.8

Public Input to Changes In Factor Ranking Levels

FACTOR	JUNE 1985[1]	FINAL RANK[2]	PUBLIC INPUT
IMPACT			
° Social Stability - (Cont'd)	4	8	Overall weights of Factor Groupings were changed as follows: - Impacts on Residents - from 4,300 to 5,300 (IER weight) - Impacts on Community and Region - no change ° the overall rankings compiled by M.M. Dillon reflects these changes
° Community character	4	8	° see Social stability
° Social cohesion	3	6	° see social stability

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[1] Ranking presented in Background Material for OWMC Phase 4A Site Selection Workshops, Volume 2, June 1985. Rankings are from 1 to 5 (5 is most important).

[2] Ranking developed by the site selection coordinating consultant (M.M. Dillon) based upon the consultants' rankings for the purpose of comparing siting options. Rankings have been transformed to ten levels (1 to 10 with 10 being most important).

TABLE B.9

Application of Risk Factor Ranking Criteria

FACTOR	SEVERITY OF RISK	FREQUENCY OF OCCURRENCE	MITIGATION POTENTIAL	PUBLIC INPUT	FACTOR RANKING
Transportation risks on local and regional access roads due to hazard-based spills of OWMC-generated transport	° margin of safety much less than one; largely reversible effects; severity of effects dependent on nature and type of spill and proximity and sensitivity of individuals involved ° AMOS is 1×10^{-2} (accident-related spills only)	° for waste streams where a major spill can result in a margin of safety of less than one (measurable health effects) 9% of the total waste quantity shipped; one spill every 13 to 277 years for all special wastes and 34 to 654 years for spills associated with truck accidents for all special wastes; many of the effects between the worst case and the margin of safety of one would be very mild ° assumes a person at a location 20 m from a spill ° even smaller probability of spills at locations where potential for human exposure ° not included within province-wide data ° in contrast to much of the balance of the province-wide system:	° mitigation cannot be assumed ° mitigation of spill possible through fast response and clean-up ° potential for evacuation in extreme cases ° detection after the fact only	° local and regional access road risks are perceived as more important than province-wide at public workshops ° transportation factors perceived as most important risk factor overall at public workshops	10

TABLE B.9

Application of Risk Factor Ranking Criteria

FACTOR	SEVERITY OF RISK	FREQUENCY OF OCCURRENCE	MITIGATION POTENTIAL	PUBLIC INPUT	FACTOR RANKING
Transportation risks on local and regional access roads due to hazard-based spills of OWMC-generated transport (Cont'd)		- OWMC traffic tends to be a higher proportion of total road traffic - function of roads less consistent with haulage of untreated wastes - people and sensitive use, such as schools, tend to be closer			
Transportation risks on local and regional access roads due to accident involvements of OWMC-generated transport	° potentially severe effects: injury - death ° of projected accidents, proportion of severe effects is low - 0.1 to 1.3 injury accidents per year and one fatal accident every 28 to 244 years	° annual OWMC vehicle accident involvement frequency on local and regional roads for year 2000 ranges from 0.5 to 3.9 ° not included within province-wide data ° in contrast to much of the balance of the province-wide system: - OWMC tends to be a higher proportion of total road traffic - function of roads less consistent with haulage of untreated wastes - people and sensitive uses, such as schools, tend to be closer	° mitigation cannot be assumed ° potential severity/ frequency of accidents can be reduced through road design and transportation operating procedures	° local and regional access road risks are perceived as more important than province-wide access road risks (OWMC public workshops) ° transportation factors perceived as most important risk factors at public workshops	10

TABLE B.9

Application of Risk Factor Ranking Criteria

FACTOR	SEVERITY OF RISK	FREQUENCY OF OCCURRENCE	MITIGATION POTENTIAL	PUBLIC INPUT	FACTOR RANKING
Capability of providing natural containment	° degree of hazard of materials minimized by treatment and solidification and through design and operations ° actual range of leachate quality will not be known until some time after facility is in operation; given uncertainty, some risk of illness and/or cancer assumed ° detailed hydrogeologic information required for site-specific assessment of ground water flow and contaminant transport not available in Phase 4A ° assumed that leachate not highly toxic, but may not meet all Ontario drinking water objectives; degree of hazard may be further reduced through attentuation properties of silt-clay soils; will vary by site	° in the case of the incinerator/physical/chemical treatment plant potential for release can be minimized through design and operating procedures; further attenuation may be provided by silt-clay soils ° occurrence will vary depending on degree of natural containment provided by site	° possible to take remedial actions during operations and initial post-closure period; not possible to assure long-term mitigation with landfill	° ground water risk perceived as second most important risk factor at public workshops	10

TABLE B.9

Application of Risk Factor Ranking Criteria

FACTOR	SEVERITY OF RISK	FREQUENCY OF OCCURRENCE	MITIGATION POTENTIAL	PUBLIC INPUT	FACTOR RANKING
Risk from direct inhalation of emissions - chronic	° risks levels acceptable - less than 1 in 1,000,000 (10^{-6}) lifetime risk of cancer at point of maximum concentration for stack (9×10^{-7}) ° 1 in 1,000,000 (10^{-6}) lifetime risk of cancer at boundary of buffer zone for fugitive emissions ° because of conservative assumptions, actual risk levels would be much lower ° risks not considered as significant health hazard	° continuous exposure to emissions ° exposure concentrations decrease with distance from point of maximum concentration for stack (1 - 3 km from stack)	° limited opportunity for detection and mitigation	° factor was ranked as third most important factor at public workshops	9
Annual province-wide accident involvements of OWMC-generated transport	° of accidents predicted, 0.7 to 2.1 injury accidents are expected to occur per annum; one fatal accident is expected every 16 to 46 years	° annual OWMC vehicle accident involvement frequency for year 2000 ranges from 0.77 to 2.1 ° setbacks for residences and other features is greater for provincial access roads	° mitigation cannot be assumed ° potential severity/ frequency of accidents can be reduced through road design and transportation operating procedures	° although public concern is high - local and regional roads perceived as more important at public workshops ° transportation risks ranked as most important risk factors overall at	8

TABLE B.9

Application of Risk Factor Ranking Criteria

FACTOR	SEVERITY OF RISK	FREQUENCY OF OCCURRENCE	MITIGATION POTENTIAL	PUBLIC INPUT	FACTOR RANKING
Annual province-wide accident involvements of OWMC-generated transport (Cont'd)	° potential for severe accidents can be reduced by vehicle design and road design and through transportation operating procedures ° greater setbacks along provincial roads reduces severity of risk to populations along access roads			public workshops	
Annual province-wide hazard-based spill index of OWMC-generated transport	° margin of safety much less than one; largely reversible effects; severity of effects dependent on nature and type of spill and proximity and sensitivity of individuals involved ° AMOS 1 x 10^{-2} for local and regional roads - accident related spills only ° AMOS will not vary for provincial roads except that setbacks are normally greater than 20 m assumed for exposure which will reduce severity of risk	° for waste streams where a major spills of all types can result in a margin of safety of less than one (measurable health effects) (9% of total waste quantity shipped) one spill very 5.5 to 9.1 years; many of the effects between the worst case and the margin of safety of one would be very mild ° assumes a person at a location 20 m from a spill	° mitigation cannot be assumed ° mitigation of spill possible through fast response and clean-up ° potential for evacuation in extreme cases ° detection after the event only	° local and regional roads perceived as more important than provincial roads at public workshops ° transportation risk perceived as most important risk factor at public workshops	8

TABLE B.9

Application of Risk Factor Ranking Criteria

FACTOR	SEVERITY OF RISK	FREQUENCY OF OCCURRENCE	MITIGATION POTENTIAL	PUBLIC INPUT	FACTOR RANKING
Annual province-wide hazard-based spill index of OWMC-generated transport (Cont'd)		° setbacks for residents and other features is greater for provincial access roads ° even smaller probability of spills at locations where potential for human exposure			
Risk from direct inhalation of emissions - acute	° some events potentially severe for individuals in immediate proximity of event; margin of safety well within one ° probable effects of scrubber failure mild and reversible ° levels of exposure from tank farm fire not sufficient to cause death or incapacitating illness ° mixing of incompatible wastes of least concern with regard to risk to human health (AMOS much greater than one)	° likelihood of fire expected to be extremely remote - not expected to occur during operating life of facility; likelihood of events which would prove a risk to the health of area residents would be even more remote ° scrubber failure likelihood higher; duration of event is short	° mitigation cannot be assumed; effects may be limited by fast response and contingency plans (e.g. evacuation) ° effects may occur before remedial action possible	° fourth most important risk factor based on public input at workshops	8

TABLE B.9

Application of Risk Factor Ranking Criteria

FACTOR	SEVERITY OF RISK	FREQUENCY OF OCCURRENCE	MITIGATION POTENTIAL	PUBLIC INPUT	FACTOR RANKING
Potential for surface water use interference	° potentially severe if release of untreated waste into watercourse and direct human consumption	° lateral migration to surface water uses by means of fracture zone - a potential concern ° long-term potential for leachate migration related to ground/surface water use a secondary consideration; primary consideration is natural containment as any use represents a potential concern	° release as a result of flooding expected to be avoidable by design and operations; may also be naturally diluted in streams; may be possible to notify users prior to consumption and provide alternative supplies ° release as a result of a leak or spill (incinerator/physical/chemical treatment plant) largely mitigable through design and operations; likelihood of a leak or spill of a concentration which would represent a risk to health very remote ° with short-term event there is mitigation potential - may be possible to notify users prior to consumption; can monitor water quality until no longer a problem; can provide alternative water supplies in the interim	° ranked as fifth most important risk factor (third least) at public workshops ° public supported higher ranking for this factor than for flooding potential	7

TABLE B.9

Application of Risk Factor Ranking Criteria

FACTOR	SEVERITY OF RISK	FREQUENCY OF OCCURRENCE	MITIGATION POTENTIAL	PUBLIC INPUT	FACTOR RANKING
Ground water use	° secondary consideration to natural containment; any use of ground water a concern if no or inadequate natural containment provided ° potentially severe effects if release of untreated waste into ground water and direct human consumption	° lateral migration to ground water sources a potential concern ° natural containment will reduce potential for contamination	° with limited or no use of ground water may be possible to provide alternative sources of water ° use dilution available in the aquifer as a further means of reducing concentration ° mitigation potential; monitoring and provision of alternative water supply and/or other remedial actions if concern identified; cannot assume restriction of ground water use over period during which leachate migration possible ° mitigation more difficult with extensive use of ground water and/or if alternative supply of water not available	° hydrogeology was ranked as most important risk factor at public workshops but no public input regarding this factor relative to natural containment	7

TABLE B.9

Application of Risk Factor Ranking Criteria

FACTOR	SEVERITY OF RISK	FREQUENCY OF OCCURRENCE	MITIGATION POTENTIAL	PUBLIC INPUT	FACTOR RANKING
Risk from ingestion of cistern and pond water	• predicted severity of risk - negligible: - one in 10,000,000 risk of cancer (10^{-7}) stack emissions - cisterns and ponds - 10^{-8} - fugitive emissions - cisterns and ponds	• chronic emissions from incinerator into cisterns and ponds • use of cisterns and ponds for water consumption determines frequency of risk	• indirect pathways - possible (although difficult) to monitor contaminant levels and to take remedial actions prior to long-term risk to human health	• air quality pathways ranked as third most important risk factor grouping at public workshops	6
Risks from consumption of crops and livestock	• predicted severity of risk negligible: - 10^{-7} - stack emissions - livestock - 10^{-7} - stack emissions - crops - 10^{-10} - fugitive emissions - livestock - 10^{-8} - fugitive emissions - crops	• exposure of crops may be chronic • frequency of consumption of animals and crops grown in area exposed to emissions determines frequency of risk	• indirect pathways - possible (although difficult) to monitor contaminant levels and to take remedial actions prior to long-term risk to human health	• air quality pathways ranked as third most important risk factor grouping at public workshops	5
Susceptibility of site to flooding	• potentially severe if release of untreated wastes into watercourse and direct human consumption	• upset events only	• severity and frequency expected to mitigable • possible to design and operate facility in a manner which would avoid a surface water release	• surface water ranked as sixth most (third least) important risk factor at public workshops • public agreed that this factor is of lower importance than surface water use	3

TABLE B.10

Application of Impact Factor Ranking Criteria For Highly Ranked Factors

Ranking Criteria	Ranking
STUDY AREA:	Site Vicinity
FACTOR:	Disruption of day-to-day activities and/or the use and enjoyment of property (adjacent)
	MAGNITUDE
Potential for Impact	° some noise and visual impacts are certain
Severity of Impact	° potentially serious impacts (increased sound levels, intermittent noise, truck traffic, dust, visual intrusion, the possibility of evacuation and possible loss of neighbours, stress, uncertainty, image change)
Frequency/Duration	° direct and long-term impacts ° impacts will occur during both construction and operation of the facility and possibly 24 hours a day
Relationship to Other Factors	° representative of a broad range of social, economic and land use impacts
	IMPORTANCE
Significance	° potentially includes sensitive populations
Public Input	° impacts on residents considered as one of most important impact factor groupings at public workshops ° public input indicated that those residents left behind would be impacted to a greater extent than those displaced and should be given a higher weight
Public Policy Concern	° not a specific public policy concern

TABLE B.10

Application of Impact Factor Ranking Criteria For Highly Ranked Factors

Ranking Criteria	Ranking
	TEMPERING CONSIDERATIONS
Mitigation	° may not be fully mitigable ° compensation will reduce impacts (e.g. a property value protection plan) ° noise mitigation is possible at site
Certainty of Predictions	° potential for serious, unanticipated impacts particularly due to role of perceived impacts
FACTOR RANK: 10	

STUDY AREA: Site Vicinity

FACTOR: Disruption of adjacent farm operations

Ranking Criteria	Ranking
	MAGNITUDE
Potential for Impact	° high certainty some impacts will occur
Severity of Impact	° range of potential impacts ° potentially serious impacts for individual operations as a result of noise, traffic, visual intrusion and property value changes
Frequency/Duration	° direct and long-term impacts ° individuals affected in their day-to-day activities for the life of the facility
Relationship to Other Factors	° representative of other agricultural impacts; highly interrelated with other social, economic and land use factors because disruption of operations could result in economic losses for the farm operators and the local community
	IMPORTANCE
Significance	° important component of local and regional and provincial economy; uses sensitive to change

TABLE B.10

Application of Impact Factor Ranking Criteria For Highly Ranked Factors

Ranking Criteria	Ranking
Public Input	° agriculture ranked as important impact factor grouping at public workshops ° public indicated a desire to assign more weight to impacts in vicinity and community and region and less for factors for which compensation is available, i.e. on-site and partial displacement
Public Policy Concern	° local and provincial policies considered
	TEMPERING CONSIDERATIONS
Mitigation	° impacts may not be fully mitigable; may not be possible to, for example, fully attenuate noise or to prevent such effects as visual intrusion, community character and traffic changes; farm operation may be dependent on network of properties which are difficult to replace ° property value protection plan may reduce impacts
Certainty of Predictions	° potential for serious unanticipated impacts particularly due to role of perceived impacts
FACTOR RANK: 10	

STUDY AREA: Site

FACTOR: Displacement of residents

	MAGNITUDE
Potential for Impact	° displacement will occur
Severity of Impact	° potentially serious impacts on individuals involved ° direct severe impacts
Frequency/Duration	° impacts of relocation can affect people for many years although perhaps not as long as for those adjacent

TABLE B.10

Application of Impact Factor Ranking Criteria For Highly Ranked Factors

Ranking Criteria	Ranking
Relationship to Other Factors	° connections to other social and land use impacts in the site vicinity and at the community level
	IMPORTANCE
Significance	° potential displacement of significant populations
Public Input	° impacts on residents ranked as one of most important impact factors at public workshops ° public input indicated that residents left behind would be impacted to greater extent than those displaced and, therefore, should be given a higher weight than displacement
Public Policy Concern	° not a specific public policy concern
	TEMPERING CONSIDERATIONS
Mitigation	° compensation will reduce impacts, but not fully mitigate all impacts ° the psychological and, in some instances, economic effects (e.g. impacts of displacement and relocation) can affect people for many years
Certainty of Predictions	° high degree of confidence in data; better sense of personal impacts would require interviews
FACTOR RANK: 9	

STUDY AREA: Site Vicinity

FACTOR: Disruption of day-to-day activities and/or the use and enjoyment of property (non-adjacent)

	MAGNITUDE
Potential for Impact	° some impacts expected (as for adjacent), but to a lesser degree

TABLE B.10

Application of Impact Factor Ranking Criteria For Highly Ranked Factors

Ranking Criteria	Ranking
Severity of Impact	° moderate levels of impact anticipated; expected to decrease with distance from site ° range of possible impacts (e.g. visual intrusion, stress, uncertainty, image change)
Frequency/Duration	° long duration (over life of the facility)
Relationship to Other Factors	° representative of a range of other impacts although range and intensity of impacts not expected to be as great as with adjacent uses
	IMPORTANCE
Significance	° potentially includes sensitive population
Public Input	° impacts on residents considered to be one of most important factor groupings ° the kinds and duration of impacts were considered by those involved in the public consultation activity to be significant, but of less severity than those affecting the adjacent residents ° it was also felt that residents left behind would be more impacted than those displaced. However, for non-adjacent residents impacts are not expected to be great or extensive; therefore, ranked equally to displacement
Public Policy Concern	° not a specific public policy concern
	TEMPERING CONSIDERATIONS
Mitigation	° potential for amelioration through facility design and operational changes (e.g. noise reduction) ° compensation may be less than for on-site and adjacent properties ° potential for addressing perceived impacts through community consultation

TABLE B.10

Application of Impact Factor Ranking Criteria For Highly Ranked Factors

Ranking Criteria	Ranking
Certainty of Predictions **FACTOR RANK:** 9	° potential for moderately serious unanticipated impacts particularly due to role of perception
STUDY AREA: Site Vicinity **FACTOR:** Disruption of non-adjacent farm operations	
	MAGNITUDE
Potential for Impact	° expected to occur although to lesser extent than with adjacent farms
Severity of Impact	° moderate levels of impacts anticipated; less than for adjacent farms ° potential for impact increases with level of agricultural activity ° indirect impacts; day-to-day operations not expected to be directly affected, but might be affected indirectly by other impacts such as property value changes and effects on community character and image
Frequency/Duration	° long duration and potentially affects a broad geographic area and a large number of people
Relationship to Other Factors	° connected to a range of other impacts although range and intensity of impacts not expected to be as great as with adjacent uses
	IMPORTANCE
Significance	° uses potentially sensitive to change
Public Input	° major public concern ° public indicated a desire to assign more weight to impacts on vicinity and community and region factors, and less for factors for which compensation is available, i.e. on-site and partial displacement

TABLE B.10

Application of Impact Factor Ranking Criteria For Highly Ranked Factors

Ranking Criteria	Ranking
Public Policy Concern	° local and provincial policies considered
	TEMPERING CONSIDERATIONS
Mitigation	° compensation may be less than for on-site and adjacent properties ° potential for amelioration through facility design and operational changes ° potential for addressing perceived impacts through community consultation
Certainty of Predictions	° although impacts expected to be moderate, potential for more serious impacts than anticipated because of role of perception in determining social and economic impacts
FACTOR RANK: 9	
STUDY AREA: Site Vicinity **FACTOR:** Partial displacement of farms	
	MAGNITUDE
Potential for Impact	° some impacts will occur for all siting options
Severity of Impact	° could have significant impact on viability of operation ° direct impacts on individuals ° does not require relocation of farm headquarters ° degree of impact is primarily a function of proportion of land lost
Frequency/Duration	° impacts may be long-term if comparable property cannot be found in area
Relationship to Other Factors	° relationship to other agricultural, social and economic factors in site vicinity; could affect community ties

TABLE B.10

Application of Impact Factor Ranking Criteria For Highly Ranked Factors

Ranking Criteria	Ranking
	IMPORTANCE
Significance	° potentially sensitive operations could be affected
Public Input	° agriculture considered important factor grouping at public workshops ° public indicated desire to assign more weight to impacts on vicinity and community and region factors, and less for factors for which compensation is available, i.e. on-site and partial displacement
Public Policy Concern	° local and provincial concerns considered
	TEMPERING CONSIDERATIONS
Mitigation	° potentially mitigable if compensated for both acquisition of owned land and alternate land located in same general area
Certainty of Predictions	° moderate degree of confidence in data; better sense of personal impacts would require interviews
FACTOR RANK: 9	
STUDY AREA: Site Vicinity **FACTOR:** Stability of farm population	
	MAGNITUDE
Potential for Impact	° impacts may occur; partially based on voluntary decisions of farm operators and businesses
Severity of Impact	° disruption to the local agricultural community expected to be limited ° degree of disruption dependent on voluntary decisions of individuals and businesses ° OWMC will provide relatively small number of jobs and local sales (as compared with major employers)

TABLE B.10

Application of Impact Factor Ranking Criteria For Highly Ranked Factors

Ranking Criteria	Ranking
	° little secondary industry, suppliers expected to move into the community ° proximity of sites to urban centres (for worker homes) reduces impacts
Frequency/Duration	° duration dependent on perception ° effects likely to be medium-term (a few years) and to diminish with time
Relationship to Other Factors	° connections to a wide range of other factors; change in stability of farm population could have a range of land use, social and economic repercussions
	IMPORTANCE
Significance	° important component of local and regional economy; uses sensitive to change
Public Input	° important area of community concern
Public Policy Concern	° local and provincial policies considered
	TEMPERING CONSIDERATIONS
Mitigation	° little opportunity for mitigation ° success of mitigating other impacts will affect severity of impact for this factor ° land use controls on non-agricultural developments possible
Certainty of Predictions	° only moderate degree of confidence in qualitative interpretations ° difficult to estimate degree to which out-migration will occur ° although impacts expected to be relatively minor to moderate, potential for more severe impacts than anticipated because of role of perception ° potential for serious unanticipated impacts, if, for example, considerable out-migration occurs based on perceived effects
FACTOR RANK: 9	

TABLE B.10

Application of Impact Factor Ranking Criteria For Highly Ranked Factors

Ranking Criteria	Ranking
STUDY AREA: Site **FACTOR:** Rare species	
	MAGNITUDE
Potential for Impact	° known to occur on several sites
Severity of Impact	° permanent resource loss ° potentially serious impacts on significant resource, particularly plants (not mobile)
Frequency/Duration	° may result in permanent resource loss
Relationship to Other Factors	° connections to other potential natural environment impacts - "potential for occurrence of significant features" factor related to uncertainty re: this and other factors
	IMPORTANCE
Significance	° potentially significant resource of concern to agencies and the public ° no "endangered" species (Endangered Species Act) have been confirmed
Public Input	° not referring to "endangered" species which are viewed by public as more important; therefore not considered of equal significance to factors ranked as 10 or 9 ° natural environment ranked as moderately important impact factor grouping at public workshops
Public Policy Concern	° potentially significant resource displacement of concern to agencies

TABLE B.10

Application of Impact Factor Ranking Criteria For Highly Ranked Factors

Ranking Criteria	Ranking
	TEMPERING CONSIDERATIONS
Mitigation	° may not be possible to mitigate ° may not be able to predict with certainty outcome of mitigation
Certainty of Predictions	° moderate degree of certainty, but potential for serious unanticipated impacts - hence, addition of factor "potential for occurrence of other significant features"
FACTOR RANK: 8	
STUDY AREA: Site Vicinity **FACTOR:** Existing Land Use	
	MAGNITUDE
Potential for Impact	° impacts may occur; likelihood will vary by siting option
Severity of Impact	° impacts potentially severe where direct conflict with existing land use occurs
Frequency/Duration	° impacts may be long-term where conflict with existing land use occurs ° reflects current rather than future anticipated land use
Relationship to Other Factors	° plays an overview role supplementary to other factors
	IMPORTANCE
Significance	° significant to the extent that it reflects general impacts on land base

TABLE B.10

Application of Impact Factor Ranking Criteria For Highly Ranked Factors

Ranking Criteria	Ranking
Public Input	° land use impacts ranked as of relatively moderate importance at public workshops ° public indicated that off-site land uses are of greater importance than on-site which can be compensated
Public Policy Concern	° not an important public policy concern
	TEMPERING CONSIDERATIONS
Mitigation	° limited potential to mitigate
Certainty of Predictions	° imprecise measure of impacts ° will assume minor role in decision-making
FACTOR RANK: 8	
STUDY AREA: Community and Regional	
FACTOR: Social stability	
	MAGNITUDE
Potential for Impact	° dependent on individuals' reactions to direct impacts; perceived impacts
Severity of Impact	° indirect impacts as a result of direct effects, such as traffic noise, visual intrusion; social stability changes are a consequence of people's actions, e.g. moving out as a result of direct or perceived effects ° largely perceived impacts; if actual magnitude of direct effects quite minor effects on social stability can still be relatively great because of role of perception in influencing people's actions ° degree of disruption dependent on voluntary decisions of individuals and businesses, e.g. to expand or close down business, or move out of community

TABLE B.10

Application of Impact Factor Ranking Criteria For Highly Ranked Factors

Ranking Criteria	Ranking
Frequency/Duration	° potential long-term effects
Relationship to Other Factors	° connections to a wide range of other factors ° direct impact factors connected to social stability
	IMPORTANCE
Significance	° may potentially affect sensitive populations
Public Input	° public input indicated that direct impacts on residents more important than social impacts on community and region because they are less precisely predictable
Public Policy Concern	° no specific public policy
	TEMPERING CONSIDERATIONS
Mitigation	° success of mitigation of direct impacts will influence impacts on social stability ° limited mitigation for indirect impacts possible
Certainty of Predictions	° only moderate degree of confidence in qualitative interpretations
FACTOR RANK: 8	
STUDY AREA: Community and Regional **FACTOR:** Community character	
	MAGNITUDE
Potential for Impact	° may occur, partially based on voluntary decisions of householders

TABLE B.10

Application of Impact Factor Ranking Criteria For Highly Ranked Factors

Ranking Criteria	Ranking
Severity of Impact	° indirect impacts; community character need not be directly affected by facility; consequences of current image of community, nature of facility and associated impacts and perceptions regarding how area changed with facility in place ° degree of disruption dependent on voluntary decisions of individuals and businesses; if facility viewed as major conflict with character of area, may influence actions of individuals and businesses ° although impacts expected to be relatively minor to moderate; potential for more severe impacts than anticipated because of role of perception ° OWMC represents relatively small number of jobs and local sales (as compared with major employers) which will limit impacts ° close proximity of sites to urban centres (for worker residences) will limit impacts; disruption to the local community should be quite limited
Frequency/Duration	° could represent potential long-term change or effects may diminish once facility is in operation
Relationship to Other Factors	° connections to a wide range of other factors; extent and significance of connections difficult to predict because of role of perception influencing voluntary decisions
	IMPORTANCE
Significance	° potential for impacts on sensitive populations in the community
Public Input	° public input indicated that direct impacts on residents are more important than social impacts on community and region because they are less precisely predictable
Public Policy Concern	° no specific public policy

TABLE B.10

Application of Impact Factor Ranking Criteria For Highly Ranked Factors

Ranking Criteria	Ranking
	TEMPERING CONSIDERATIONS
Mitigation	° success of mitigation measures for direct impacts will affect severity of community character impacts ° limited mitigation for indirect impact possible
Certainty of Predictions	° only moderate degree of confidence in qualitative interpretations ° difficult to use as basis for decision-making ° potential for serious unanticipated impacts
FACTOR RANK: 8	
STUDY AREA: Community and Regional **FACTOR:** Regional and community economic base	
	MAGNITUDE
Potential for Impact	° may occur; partially based on voluntary decisions of businesses, clients and customers
Severity of Impact	° direct and indirect and mainly positive impacts are possible as a result of such changes as new jobs created and potential for industrial spin-off ° some perceived impacts; investment and business operations decisions, in part, a consequence of, for example, changes in community character ° some minor to moderate local benefits as a result of local employment and the income it generates ° degree of disruption dependent on voluntary decisions of individuals and businesses although actual impacts expected to be relatively minor to moderate based on facility characteristics and potential effects; direct effects on local businesses and indirect effects on economy should be limited
Frequency/Duration	° could result in long-term impacts on economic base

TABLE B.10

Application of Impact Factor Ranking Criteria For Highly Ranked Factors

Ranking Criteria	Ranking
Relationship to Other Factors	° affects a wide range of other factors; if the economic base of an area is affected, there are likely to be social, municipal service and finance, and land use impacts
	IMPORTANCE
Significance	° large-scale economic changes may affect sensitive populations ° large-scale economic impacts of significance within community
Public Input	° community and region economic and social factors were considered of moderate to low importance at the public workshops
Public Policy Concern	° no specific public policy
	TEMPERING CONSIDERATIONS
Mitigation	° potential to decrease negative impacts if facility operated as an attraction in itself, or through economic incentives to development, if appropriate
Certainty of Predictions	° some uncertainty regarding perceived economic effects and the potential for industrial spin-off
FACTOR RANK: 8	
STUDY AREA: Community and Regional **FACTOR:** Stability of agricultural land base	
	MAGNITUDE
Potential for Impact	° may occur; partially based on voluntary decisions of farm operators and businesses

TABLE B.10

Application of Impact Factor Ranking Criteria For Highly Ranked Factors

Ranking Criteria	Ranking
Severity of Impact	° potential for impact is less where non-agricultural developments have intruded into agricultural areas and caused the rural landscape to decline in stability and diminish total agricultural outputs; future availability of land parcels in agricultural use is less certain
Frequency/Duration	° potential for long-term impacts
Relationship to Other Factors	° impacts are interconnected with other important factors
	IMPORTANCE
Significance	° potential for significant impacts if community not adaptable to change
Public Input	° agriculture ranked as important factor grouping at public workshops; impacts on stability of land base expressed as a concern
Public Policy Concern	° local and provincial policies considered
	TEMPERING CONSIDERATIONS
Mitigation	° limited mitigation possible through land use planning measures ° success of mitigating direct effect will influence impact ° land use controls on non-agricultural land uses is possible
Certainty of Predictions	° only moderate degree of confidence in qualitative interpretations
FACTOR RANK: 8	

TABLE B.10

Application of Impact Factor Ranking Criteria For Highly Ranked Factors

Ranking Criteria	Ranking
STUDY AREA: Community and Regional **FACTOR:** Disruption to farm economy	
	MAGNITUDE
Potential for Impact	° potential for effects expected to be low
Severity of Impact	° effects from emissions on crops and livestock expected to be minimal, but some uncertainty re perceived effects
Frequency/Duration	° potential long-term impacts
Relationship to Other Factors	° connection to many other factors; changes in farm economy could have many social, land use and economic repercussions
	IMPORTANCE
Significance	° agriculture is a significant and potentially sensitive resource
Public Input	° agriculture was considered as one of most important factor groupings by public
Public Policy Concern	° local and provincial policies considered
	TEMPERING CONSIDERATIONS
Mitigation	° mitigation potential could reduce significance of this factor; by addressing specific concerns of individual operations may be possible to reduce overall effects on farm economy
Certainty of Predictions	° uncertainty about effects is high
FACTOR RANK: 8	

TABLE B.10

Application of Impact Factor Ranking Criteria For Highly Ranked Factors

Ranking Criteria	Ranking
STUDY AREA: Community and Regional **FACTOR:** Tourism economy	
	MAGNITUDE
Potential for Impact	° likelihood of impacts is low
Severity of Impact	° equal in importance to regional and community economic base and disruption to farm economy factors ° potential for more severe impacts than anticipated because of role of perception ° impacts expected to be minor, but perceived as important factor and separate from other economic sectors
Frequency/Duration	° potential for long-term impacts
Relationship to Other Factors	° relationship to other economic factors
	IMPORTANCE
Significance	° significance of tourism resources varies by siting option - potentially high significance
Public Input	° perceived by public as an important factor in Niagara Falls
Public Policy Concern	° no specific public policy
	TEMPERING CONSIDERATIONS
Mitigation	° mitigation potential could reduce significance of this factor; by addressing specific concerns of individual operators may be possible to reduce overall effects

TABLE B.10

Application of Impact Factor Ranking Criteria For Highly Ranked Factors

Ranking Criteria	Ranking
Certainty of Predictions **FACTOR RANK: 8**	° uncertainty is high because of role of public perception and individual reactions to facility development

STUDY AREA: Access roads

FACTOR: Disruption of day-to-day activities and/or the use and enjoyment of property (adjacent)

	MAGNITUDE
Potential for Impact	° impacts expected to occur (both real and perceived)
Severity of Impact	° potentially minor impacts in terms of increased noise levels and potential constraints to property access ° impacts generally moderate on local and regional access road system as OWMC traffic generally a small proportion of total volumes projected for routes ° role of perceived impacts may increase impacts
Frequency/Duration	° impacts will last for duration of facility operation, but will occur only during the day
Relationship to Other Factors	° direct impacts are interconnected to community indirect factors (social stability, community character, etc.)
	IMPORTANCE
Significance	° potentially includes sensitive populations
Public Input	° impacts on residents considered to be one of most important factor groupings
Public Policy Concern	° no specific public policy

TABLE B.10

Application of Impact Factor Ranking Criteria For Highly Ranked Factors

Ranking Criteria	Ranking
	TEMPERING CONSIDERATIONS
Mitigation	° mitigation of some impacts possible
Certainty of Predictions	° potential for serious unanticipated impacts
FACTOR RANK: 8	
STUDY AREA: Access roads **FACTOR:** Disruption of farm traffic and cattle crossings	
	MAGNITUDE
Potential for Impact	° impacts expected to occur
Severity of Impact	° impacts generally moderate on regional access road system as OWMC traffic in most cases represents a small proportion of total volumes projected for routes ° impacts expected to be greater on local access roads
Frequency/Duration	° impacts will occur for duration of facility operation during daytime
Relationship to Other Factors	° affects other agricultural factors in community and region
	IMPORTANCE
Significance	° relatively low sensitivity
Public Input	° impacts on agriculture considered to be one of most important factor groupings
Public Policy Concern	° no specific public policy

TABLE B.10

Application of Impact Factor Ranking Criteria For Highly Ranked Factors

Ranking Criteria	Ranking
	TEMPERING CONSIDERATIONS
Mitigation	° mitigation of accident risk less necessary on regional roads and more difficult to achieve on local roads ° potential to mitigate cattle crossings
Certainty of Predictions	° major unanticipated impacts not expected
FACTOR RANK: 8	

TABLE B.11

Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

Ranking Criteria	Ranking
STUDY AREA: Site **FACTOR:** Planned and proposed land use	
	MAGNITUDE
Potential for Impact	° potentially could occur
Severity of Impact	° a change in land use policies or proposals can have a range of other land use, social and economic repercussions ° planned land use is a basis for public and private decision-making ° planned and proposed uses are a direct reflection of community expectations for area ° indirect impact; dependent on actions of planning staff and development interests - can alter impacts by altering planning
Frequency/Duration	° potential long-term impacts as could conflict with long-term planning for area
Relationship to Other Factors	° factor should be used in conjunction with other land use, social and economic factors ° reflects likelihood of continuation of existing uses
	IMPORTANCE
Significance	° potentially significant uses for community
Public Input	° land use considered to be of moderate importance by the public
Public Policy Concern	° important policy concern for municipality

TABLE B.11

Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

Ranking Criteria	Ranking
	TEMPERING CONSIDERATIONS
Mitigation	° potential for mitigation through joint land use planning and control
Certainty of Predictions	° moderate uncertainty; inevitable uncertainty associated with future uses
FACTOR RANK: 7	
STUDY AREA: Site Vicinity **FACTOR:** Property value impacts	
	MAGNITUDE
Potential for Impact	° some change in property values is likely
Severity of Impact	° impacts expected to be moderate and temporary; potential for more serious impacts than anticipated because of the role of perception in what people are willing to pay for property ° degree of disruption dependent on individual decisions of owners and potential purchasers, as well as their location in relation to the facility ° indirect impacts; property value changes partly dependent on perceptions and partly dependent on other impacts; if other impacts do not occur, property values may not change
Frequency/Duration	° potential impacts, both actual and perceived, may diminish over time; if actual impacts less than community expectations, property values may return to former levels ° perceptions of impact may remain strong over life of the facility
Relationship to Other Factors	° connections to a wide range of other factors such as agricultural operations, economic base and future land use

TABLE B.11

Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

Ranking Criteria	Ranking
	IMPORTANCE
Significance	° may affect sensitive populations that cannot adapt well to change
Public Input	° impacts on residents considered by public to be most important factor grouping ° concerns widely expressed regarding property devaluation
Public Policy Concern	° no specific public policy
	TEMPERING CONSIDERATIONS
Mitigation	° potential for mitigation through such measures as property value guarantees
Certainty of Predictions	° uncertainty involved in predicting property devaluation because of role of perceived impacts and the response of individual owners
FACTOR RANK: 7	

STUDY AREA: Site Vicinity

FACTOR: Planned and proposed land use

Ranking Criteria	Ranking
	MAGNITUDE
Potential for Impact	° potential for impacts
Severity of Impact	° potentially severe impact where basic conflict between proposed facilities and anticipated future land uses ° planned land use basis for public and private decision-making ° planned and proposed land uses a direct reflection of community expectations for area ° indirect impact

TABLE B.11

Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

Ranking Criteria	Ranking
Frequency/Duration	° potential long-term impacts as could conflict with long-term planning for area
Relationship to Other Factors	° affects a range of other land use, social and economic factors ° should be used in conjunction with other land uses, social and economic factors
	IMPORTANCE
Significance	° may affect significant uses
Public Input	° land use ranked as moderately important impact factor grouping by public
Public Policy Concern	° important policy concern; reflects municipal and provincial policy for future development in area
	TEMPERING CONSIDERATIONS
Mitigation	° potential for mitigation through land use planning and control
Certainty of Predictions	° moderately uncertain; inevitable uncertainty associated with future use
FACTOR RANK: 7	

STUDY AREA: Access roads

FACTOR: Disruption of day-to-day activities and/or the use and enjoyment of property (non-adjacent)

	MAGNITUDE
Potential for Impact	° potential for some limited accessibility/nuisance effects, e.g. property access, noise

TABLE B.11

Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

Ranking Criteria	Ranking
Severity of Impact	° largely perceived impacts as primary effects, such as noise largely limited to adjacent properties ° minor levels of impact anticipated; OWMC traffic on most roads, a small proportion of total traffic ° impact decrease with distance from access roads ° potential for indirect impacts
Frequency/Duration	° long-term for duration of facility operations
Relationship to Other Factors	° direct impact interconnected with impacts at a community level (e.g. community character and social cohesion)
	IMPORTANCE
Significance	° potential to affect sensitive populations
Public Input	° impacts on residents considered to be one of most important factor groupings
Public Policy Concern	° no specific public policy
	TEMPERING CONSIDERATIONS
Mitigation	° limited mitigation possible (e.g. hours of truck delivery adjustments)
Certainty of Predictions	° ability to predict importance of perceived impacts is limited
FACTOR RANK: 7	

TABLE B.11

Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

Ranking Criteria	Ranking
STUDY AREA: Site	
FACTOR: Loss of Farmland	
	MAGNITUDE
Potential for Impact	° will occur
Severity of Impact	° small amount of land displaced in absolute terms ° capability and use not as high as areas rejected during previous site selection stages
Frequency/Duration	° permanent loss of resource
Relationship to Other Factors	° connections to agricultural use, social and economic factors; direct impacts affect indirect impacts off-site
	IMPORTANCE
Significance	° moderately significant relative to areas previously rejected
Public Input	° agriculture considered to be one of most important factor groupings by public
Public Policy Concern	° identified as important public agency concern
	TEMPERING CONSIDERATIONS
Mitigation	° cannot mitigate this loss
Certainty of Predictions	° high degree of confidence in data; unanticipated concerns not expected
FACTOR RANK: 6	

TABLE B.11

Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

Ranking Criteria	Ranking
STUDY AREA: Site	
FACTOR: Displacement of farms with on-site headquarters	
	MAGNITUDE
Potential for Impact	° displacement will occur for all siting options ° compensation will reduce impacts
Severity of Impact	° potentially serious impacts on individuals if compensation not complete ° disruption of farms may be great if land holdings owned in vicinity
Frequency/Duration	° impacts of relocation can affect people for many years ° if compensation appropriate, impacts may be short-term
Relationship to Other Factors	° affects other agricultural, land use, social and economic factors in site vicinity
	IMPORTANCE
Significance	° significant to affected individual and of moderate significance at community level
Public Input	° impacts on agriculture ranked as one of most important impact factor grouping at public meetings ° displacement of farms seen as less important than disruption of farms and residents ° less weight assigned to factors for which compensation is available, based on public input from workshops
Public Policy Concern	° local and provincial policies considered

TABLE B.11

Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

Ranking Criteria	Ranking
	TEMPERING CONSIDERATIONS
Mitigation	° potentially mitigable if compensated and successfully relocated in same or comparable area ° may be difficult to replace linkages to other farms and businesses
Certainty of Predictions	° moderate degree of confidence in data; better sense of personal impacts would require interviews
FACTOR RANK: 6	
STUDY AREA: Site **FACTOR:** Potential for occurrence of other significant biological features	
	MAGNITUDE
Potential for Impact	° may occur
Severity of Impact	° potential for highly significant resources ° potential would be largely clarified through additional field work
Frequency/Duration	° displacement of potential resources could be permanent
Relationship to Other Factors	° may be related to other potential natural environment impacts such as loss of rare species (observed occurrences)
	IMPORTANCE
Significance	° some potential for highly significant resources ° a significant factor, but must be ranked lower than rare species occurrences which are presently known

TABLE B.11

Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

Ranking Criteria	Ranking
Public Input	° natural environment ranked as moderately important factor grouping by the public
Public Policy Concern	° displacement of significant resources of concern to agencies
	TEMPERING CONSIDERATIONS
Mitigation	° effects may not be mitigable ° may not be able to predict with certainty outcome of mitigation
Certainty of Predictions	° certain sites have potential for supporting rare species and significant habitat - the reality of potential will not be know until after Phase 4B field work is complete for preferred site only
FACTOR RANK: 6	
STUDY AREA: Site	
FACTOR: Existing land use	
	MAGNITUDE
Potential for Impact	° impacts will definitely occur
Severity of Impact	° direct impacts ° displacement of on-site uses ° displacement of residents considered by separate factor
Frequency/Duration	° permanent loss of land use
Relationship to Other Factors	° plays overview role supplementary to other factors

TABLE B.11

Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

Ranking Criteria	Ranking
	IMPORTANCE
Significance	° significant to the extent that it reflects general impacts on land base
Public Input	° land use impacts ranked as of relatively moderately importance at public workshops
Public Policy Concern	° not an important public policy concern
	TEMPERING CONSIDERATIONS
Mitigation	° compensation of land owners is possible
Certainty of Predictions	° imprecise measure of impacts; will assume minor role in decision-making
FACTOR RANK: 6	

STUDY AREA: Site Vicinity

FACTOR: Business activities negatively affected by presence of OWMC facilities

	MAGNITUDE
Potential for Impact	° some negative effect may occur for all siting options
Severity of Impact	° impacts expected to be moderate and indirect
Frequency/Duration	° potential long-term impacts for duration of facility operation

TABLE B.11

Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

Ranking Criteria	Ranking
Frequency/Duration	° potential long-term impacts for duration of facility operation
Relationship to Other Factors	° connections to other social and economic factors in the community
	IMPORTANCE
Significance	° not considered as sensitive population
Public Input	° impacts on businesses considered to be moderately important by the public
Public Policy Concern	° no specific public policy
	TEMPERING CONSIDERATIONS
Mitigation	° mitigation and compensation possible
Certainty of Predictions	° extent of impacts difficult to predict because of role of perceptions and uncertainty regarding business responses to OWMC facility ° role of perceived impacts are uncertain and could result in unanticipated negative impacts
FACTOR RANK: 6	
STUDY AREA: Site Vicinity	
FACTOR: Existing and anticipated air quality	
	MAGNITUDE
Potential for Impact	° very limited impact will occur

TABLE B.11

Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

Ranking Criteria	Ranking
Severity of Impact	° incremental effect on air quality due to the OWMC facility would be small - well within guidelines ° existence of polluting industries is considered a potential constraint for future operations of OWMC
Frequency/Duration	° long-term for life of the facility
Relationship to Other Factors	° perceived to be linked to potential agricultural, economic and social impacts
	IMPORTANCE
Significance	° impacts on sensitive populations not a concern; significant restraints avoided in earlier stages of analysis
Public Input	° impacts on the natural environment considered to be moderately important by the public
Public Policy Concern	° effect on air quality due to OWMC facility would be well within provincial guidelines
	TEMPERING CONSIDERATIONS
Mitigation	° mitigation of existing sources outside control of OWMC
Certainty of Predictions	° uncertainty regarding airshed management program being implemented and affecting OWMC operations
FACTOR RANK: 6	

STUDY AREA: Community and Regional

FACTOR: Social cohesion

Potential for Impact	° impact might occur

TABLE B.11

Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

Ranking Criteria	Ranking
Severity of Impact	° indirect impacts; social cohesion not directly impacted, but may be influenced by other impacts or perceived impacts ° degree of disruption dependent on voluntary decisions of individuals and businesses regarding changes in patterns of social and economic interaction in response to facility's presence ° largely perceived impacts; size and nature of facility operations not such that major effects on social cohesion should reasonably occur ° OWMC generates relatively small number of jobs and locals sales (as compared with major employers) ° proximity of sites to urban centres (for worker residences) will reduce impacts; disruption to the local community might be quite limited
Frequency/Duration	° potential long-term impacts
Relationship to Other Factors	° interrelated with direct impact factors and also related to other community, social and economic factors
	IMPORTANCE
Significance	° could affect sensitive populations
Public Input	° public input indicated that direct impacts on residents are more important than social impacts on community and region because they are less precisely predictable
Public Policy Concern	° no specific public policy
	TEMPERING CONSIDERATIONS
Mitigation	° mitigation of direct impacts will reduce severity of impact on social cohesion

TABLE B.11

Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

Ranking Criteria	Ranking
Certainty of Predictions **FACTOR RANK: 6**	° only moderate degree of confidence in qualitative interpretations ° actual extent of out-migration and resultant disruption of features is unknown ° data available can only partially assess social cohesion ° role of perceived impacts could lead to unanticipated serious impacts
STUDY AREA: Community and Regional **FACTOR:** Municipal finance	
	MAGNITUDE
Potential for Impact	° will occur
Severity of Impact	° moderate impacts possible ° most siting configurations expected to represent net benefit to local taxpayers by broadening assessment base
Frequency/Duration	° long-term benefits
Relationship to Other Factors	° connections to a range of land use, social and economic impacts
	IMPORTANCE
Significance	° not considered of high significance
Public Input	° little public input received regarding municipal finance, but general economic effects on the community considered to be of relatively low importance

TABLE B.11

Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

Ranking Criteria	Ranking
Public Policy Concern	° public policy concern, but expected to be compatible
	TEMPERING CONSIDERATIONS
Mitigation	° OWMC commitment that no municipality will suffer financially
Certainty of Predictions	° moderate uncertainty regarding long-term forecasting of financial and service implications
FACTOR RANK: 6	

STUDY AREA: Community and Regional

FACTOR: Tourism operations

	MAGNITUDE
Potential for Impact	° likelihood of impact is low
Severity of Impact	° impacts expected to be relatively minor as few tourist operations in close proximity to sites; however, potential for more serious impacts than anticipated because of role of perception
Frequency/Duration	° potential long-term impacts
Relationship to Other Factors	° related to other economic factors
	IMPORTANCE
Significance	° potentially high significance
Public Input	° important public concern in Niagara Falls

TABLE B.11

Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

Ranking Criteria	Ranking
Public Policy Concern	° no specific public policy
	TEMPERING CONSIDERATIONS
Mitigation	° mitigation may reduce some impacts ° mitigation of concerns of individual operators may reduce overall impacts
Certainty of Predictions	° certainty of predictions is low
FACTOR RANK: 6	
STUDY AREA: Site Vicinity **FACTOR:** Disruption of operations of community and recreation features (adjacent)	
	MAGNITUDE
Potential for Impact	° not all siting options have adjacent features, but of those that exist, all could be impacted
Severity of Impact	° direct nuisance and indirect impacts ° degree of disruption dependent on voluntary decisions of users and operators ° element of perception involved regarding degree of impact
Frequency/Duration	° anticipated to be largely related to perception and to become less over time ° duration will be during facility operation working hours
Relationship to Other Factors	° related to other social factors in community and region

TABLE B.11

Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

Ranking Criteria	Ranking
	IMPORTANCE
Significance	° users may be sensitive and of importance to the local community
Public Input	° community facilities and services considered to be of relatively low importance by the public
Public Policy Concern	° not an important public policy concern
	TEMPERING CONSIDERATIONS
Mitigation	° potentially mitigable on a feature-by-feature basis
Certainty of Predictions	° moderate degree of uncertainty associated with perceived impacts ° potential for serious unanticipated impacts ° potential disruption cannot be reassured or predicted with certainty for some impacts because it depends largely on voluntary decisions of users
FACTOR RANK: 5	
STUDY AREA: Site	
FACTOR: Natural vegetation displaced	
	MAGNITUDE
Potential for Impact	° expected to occur on all sites
Severity of Impact	° effects expected to be relatively minor ° direct impacts - permanent resource loss
Frequency/Duration	° permanent resource loss

TABLE B.11

Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

Ranking Criteria	Ranking
Relationship to Other Factors	° factor generally indicative of biological significance of site ° rare species and habitat with potential to hold other significant features covered by other factors
	IMPORTANCE
Significance	° relatively insignificant resources ° no sites have extensive blocks of forest or other habitat types which are required by species having large territories
Public Input	° public concurred that loss of "common" species of vegetation should be ranked lower than loss of "rare" species
Public Policy Concern	° generally no agency policy regarding this factor
	TEMPERING CONSIDERATIONS
Mitigation	° may be mitigable through facility location
Certainty of Predictions	° high degree of confidence in data; limited potential for identifying significant/sensitive resource without further study
FACTOR RANK: 4	
STUDY AREA: Site **FACTOR:** Displacement of businesses	
	MAGNITUDE
Potential for Impact	° wide variations in terms of employment and sales ° potential of retention of uses on some sites
Severity of Impact	° magnitude of economic activities potentially displaced by OWMC is comparatively small

TABLE B.11

Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

Ranking Criteria	Ranking
Frequency/Duration	° short-term impacts provided displaced uses relocated with appropriate compensation
Relationship to Other Factors	° connected to other social and economic factors off-site (e.g. social stability, community character, economic stability)
	IMPORTANCE
Significance	° not considered as a sensitive population
Public Input	° displacement not perceived by public as important as disruption in site vicinity ° impacts on businesses of moderate concern
Public Policy Concern	° not considered an important public policy concern
	TEMPERING CONSIDERATIONS
Mitigation	° largely mitigable impacts ° displaced businesses can be relocated - no permanent loss
Certainty of Predictions	° high level of certainty
FACTOR RANK: 4	

STUDY AREA: Site Vicinity

FACTOR: Business activities positively affected by presence of OWMC facilities

	MAGNITUDE
Potential for Impact	° some positive impacts likely for most siting options

TABLE B.11

Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

Ranking Criteria	Ranking
Severity of Impact	° impacts expected to be minor ° initiative of individual businesses will affect impacts
Frequency/Duration	° for duration of operation
Relationship to Other Factors	° direct impacts on businesses will be connected to other social and economic factors in the community
	IMPORTANCE
Significance	° populations are not considered as sensitive
Public Input	° impacts on businesses a moderate concern
Public Policy Concern	° not considered an important public policy concern
	TEMPERING CONSIDERATIONS
Mitigation	° not applicable
Certainty of Predictions	° whether positive impacts occur depends on the extent to which businesses take advantage of possible opportunities
FACTOR RANK: 4	
STUDY AREA: Site Vicinity **FACTOR:** Significant environmental units	
	MAGNITUDE
Potential for Impact	° published reports document these features ° likelihood of impact is low

TABLE B.11

Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

Ranking Criteria	Ranking
Severity of Impact	° zero to minor indirect impacts anticipated because of facility characteristics, anticipated impacts and proximity of SEUs ° however, for purposes of siting option comparison, complete loss of all features is assumed ° noise, fugitive emissions, sedimentation and changes in drainage patterns and soil moisture regimes might occur around site margin
Frequency/Duration	° expected to be very infrequent ° disruption to feature could be for life of facility
Relationship to Other Factors	° connected to other biological factors
	IMPORTANCE
Significance	° known to contain significant features - sensitivity not known, but potential for occurrence exists ° broad range of known significant biological features; provide habitat for rare species of regional significance in some cases ° recognized as the more significant areas by agencies and public groups
Public Input	° natural environment considered to be of moderate importance; SEUs recognized as important by public groups
Public Policy Concern	° provincially and regionally significant resource from a policy perspective
	TEMPERING CONSIDERATIONS
Mitigation	° potentially mitigable
Certainty of Predictions	° published documentation consistent across sites ° sensitivity of features not known
FACTOR RANK: 4	

TABLE B.11

Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

Ranking Criteria	Ranking
STUDY AREA: Community and Regional **FACTOR:** Existing land use	
	MAGNITUDE
Potential for Impact	° likelihood of impact is relatively low
Severity of Impact	° indirect impacts; uses beyond 2 km not expected to be directly affected ° impacts expected to be less than for other study areas ° possible area of concern if impacts can be demonstrated on uses just beyond site vicinity
Frequency/Duration	° long-term
Relationship to Other Factors	° supplementary role to other social, economic and land use factors; provides overview of relationship of use to broad pattern of land use in community and region
	IMPORTANCE
Significance	° significant to the extent that it reflects general impacts on land base
Public Input	° land use impacts ranked as of relatively moderate importance at public workshops
Public Policy Concern	° not an important public policy concern
	TEMPERING CONSIDERATIONS
Mitigation	° little potential for mitigation
Certainty of Predictions	° imprecise measure - will not assume a major role in decision-making
FACTOR RANK: 4	

TABLE B.11

Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

Ranking Criteria	Ranking
STUDY AREA: Community and Regional **FACTOR:** Planned and proposed land use	
	MAGNITUDE
Potential for Impact	° likelihood of impacts is low
Severity of Impact	° indirect impacts; planned and proposed land uses more than 2 km from facility not likely to be directly affected; indirect effects if, for example, influences investment, decisions of developers, builders or potential home or businesses' owners ° impacts likely to be less than for other study areas ° possible area of concern if impacts can be demonstrated on future uses just beyond site vicinity
Frequency/Duration	° potentially long-term
Relationship to Other Factors	° supplementary role to other social and economic factors
	IMPORTANCE
Significance	° potentially significant uses for community
Public Input	° land use considered to be of moderate importance by public
Public Policy Concern	° of concern to public agencies
	TEMPERING CONSIDERATIONS
Mitigation	° potentially mitigable through planning or policy change if concern identified
Certainty of Predictions	° high level of uncertainty regarding future land use decisions
FACTOR RANK: 4	

TABLE B.11

Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

Ranking Criteria	Ranking
STUDY AREA: Access roads **FACTOR:** Existing land use	
	MAGNITUDE
Potential for Impact	° likelihood of impact is low
Severity of Impact	° impacts generally expected to be very minor and indirect for all sites except where urban land uses affected ° impacts on residents considered under separate factor
Frequency/Duration	° long-term
Relationship to Other Factors	° factor plays minor overview role supplementary to other factors
	IMPORTANCE
Significance	° significant to the extent that it reflects general impacts on land base
Public Input	° land use impacts ranked as moderately important at public workshops
Public Policy Concern	° no agency policy conflict
	TEMPERING CONSIDERATIONS
Mitigation	° mitigation of individual concerns along access roads may reduce overall impact
Certainty of Predictions	° imprecise measure of impacts; should assume minor role in decision-making
FACTOR RANK: 4	

TABLE B.11

Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

Ranking Criteria	Ranking
STUDY AREA: Access roads **FACTOR:** Planned and proposed land uses	
	MAGNITUDE
Potential for Impact	° likelihood of impact is low
Severity of Impact	° OWMC traffic, in most instances, a small proportion of total traffic ° impacts generally expected to be minor and indirect except for potentially significant uses such as major residential development proposals
Frequency/Duration	° long-term
Relationship to Other Factors	° a major change in land use which proceeds or fails to proceed can affect a range of other land use, social and economic factors
	IMPORTANCE
Significance	° potentially significant uses for community such as major residential development proposals
Public Input	° land use considered to be of moderate importance by public
Public Policy Concern	° potential policy conflict with local or regional official plans
	TEMPERING CONSIDERATIONS
Mitigation	° future land use along regional access system likely to be subject to reverse frontages, setback, access restrictions, etc. which likely to limit conflict ° potential for additional measures, e.g. noise attenuation, access changes if significant concern identified

TABLE B.11

Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

Ranking Criteria	Ranking
Certainty of Predictions **FACTOR RANK:** 4	° high level of uncertainty associated with future land uses
STUDY AREA: Access roads **FACTOR:** Disruption to crop and livestock production	
	MAGNITUDE
Potential for Impact	° some impacts are likely
Severity of Impact	° indirect minor impacts to farm operators
Frequency/Duration	° frequency of occurrence very low ° potential for all spills of waste streams with potential for risk to human health (9%) is one every 30 to 277 years for local and regional roads, and 5.5 to 9.1 years on provincial roads ° the probability of a spill adjacent to agricultural land is less than this
Relationship to Other Factors	° connected to other social and agricultural factors in community and region
	IMPORTANCE
Significance	° considered to be of moderate significance
Public Input	° agriculture considered to be one of most important factor groupings by public
Public Policy Concern	° not considered to be a significant public policy concern

TABLE B.11

Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

Ranking Criteria	Ranking
	TEMPERING CONSIDERATIONS
Mitigation	° opportunities exist for mitigation and compensation; spill can be cleaned up and crop area affected removed, compensation can be paid
Certainty of Predictions	° some uncertainty regarding potential extent of impacts
FACTOR RANK: 4	
STUDY AREA: Access roads **FACTOR:** Fish communities	
	MAGNITUDE
Potential for Impact	° likelihood of spill into watercourse such that fish mortality occurs is extremely remote
Severity of Impact	° potential direct impact - fish mortality
Frequency/Duration	° potential for impacts exists during entire life of facility ° impacts expected to be short-term
Relationship to Other Factors	° little relationship to other factors
	IMPORTANCE
Significance	° not considered to be of high significance, but depends on characteristics of receiving stream
Public Input	° natural environment considered to be of moderate importance by the public

TABLE B.11

Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

Ranking Criteria	Ranking
Public Policy Concern	° a public policy concern
	TEMPERING CONSIDERATIONS
Mitigation	° potential for remedial actions; bridges can, for example, be modified to reduce the potential for spills escaping directly into certain watercourses ° need and types of mitigation would have to be assessed on a crossing-by-crossing basis ° spill clean-up could minimize impact of spill
Certainty of Predictions	° uncertainty exists with regard to severity of impacts
FACTOR RANK: 4	
STUDY AREA: Site **FACTOR:** Displacement of community and recreation features	
	MAGNITUDE
Potential for Impact	° will occur for some siting options
Severity of Impact	° no major community features such as community centres or schools on candidate sites (historic features only) ° degree of displacement of such features minimal
Frequency/Duration	° would result in permanent loss if mitigation not successful ° effects short-term
Relationship to Other Factors	° little interconnection to other factors
	IMPORTANCE
Significance	° loss of structures of historic value only (no user impacts); less significance than impacts on residents

TABLE B.11

Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

Ranking Criteria	Ranking
Public Input	° impacts to community facilities and services considered to be of relatively low importance by the public
Public Policy Concern	° not an important public policy concern
	TEMPERING CONSIDERATIONS
Mitigation	° assumes commitment by OWMC to mitigate displacement of historic features
Certainty of Predictions	° qualitative interpretation and dependent on voluntary decisions by users
FACTOR RANK: 3	

STUDY AREA: Site Vicinity

FACTOR: Disruption of operations of community and recreation features (vicinity)

	MAGNITUDE
Potential for Impact	° all siting options have features in site vicinity
Severity of Impact	° low levels of impact expected ° impacts decrease with distance from site
Frequency/Duration	° impacts could continue for life of facility
Relationship to Other Factors	° direct impact on features will be connected to indirect community level impacts (e.g. community character, social cohesion)
	IMPORTANCE
Significance	° sensitive users may be impacted

TABLE B.11

Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

Ranking Criteria	Ranking
Public Input	° community facilities and services considered to be of relatively low importance by public
Public Policy Concern	° not an important public policy concern
	TEMPERING CONSIDERATIONS
Mitigation	° potentially mitigable on a feature-by-feature basis
Certainty of Predictions	° limited ability to predict perceived impacts ° some uncertainty regarding level of impacts expected (e.g. noise)
FACTOR RANK: 3	
STUDY AREA: Site Vicinity **FACTOR:** Land use stability	
	MAGNITUDE
Potential for Impact	° likelihood of impacts low
Severity of Impact	° indirect impacts
Frequency/Duration	° potential impacts for life of facility
Relationship to Other Factors	° ancillary or secondary factor; should be used to temper other land use, economic, social and agricultural factors rather than as representing major concern by itself
	IMPORTANCE
Significance	° not considered to be significant impact
Public Input	° land use considered to be a moderately important factor

TABLE B.11

Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

Ranking Criteria	Ranking
Public Policy Concern	° does not represent a direct conflict with a given agency policy
	TEMPERING CONSIDERATIONS
Mitigation	° limited potential to mitigate ° may not be necessary to mitigate
Certainty of Predictions	° data of limited reliability for use in decision-making
FACTOR RANK: 3	
STUDY AREA: Site Vicinity **FACTOR:** Other natural vegetation	
	MAGNITUDE
Potential for Impact	° other natural vegetation occurs around all sites
Severity of Impact	° no to minor indirect impacts anticipated ° for purposes of analysis, loss of all features assumed in site vicinity ° noise, fugitive emissions, sedimentation and changes in drainage pattern and soil moisture regimes may occur around site margin
Frequency/Duration	° potential impacts could result in permanent damage or loss, but effects expected to be very infrequent
Relationship to Other Factors	° connected to other biological factors
	IMPORTANCE
Significance	° may represent significant features susceptible to impact ° biological significance may vary

TABLE B.11

Application of Impact Factor Ranking Criteria For Moderately Ranked Factors

Ranking Criteria	Ranking
Public Input	o natural environment considered to be a moderately important factor grouping by the public
Public Policy Concern	o not an important public policy concern
	TEMPERING CONSIDERATIONS
Mitigation	o impacts may be mitigable o potential for providing rare species and significant fish and wildlife habitat
Certainty of Predictions	o biological significance unknown o sensitivity presently unknown - aerial photos allow a level of confirmation
FACTOR RANK: 3	

TABLE B.12

Application of Impact Factor Ranking Criteria For Low Ranked Factors

Ranking Criteria	Ranking
STUDY AREA: Site **FACTOR:** Archaeological resources	
	MAGNITUDE
Potential for Impact	° some impact will occur on all sites, but mitigation will greatly reduce level of impact
Severity of Impact	° displacement or disruption of a resource permanently
Frequency/Duration	° permanent resource loss
Relationship to Other Factors	° little relationship to other factors
	IMPORTANCE
Significance	° relatively high level of significance
Public Input	° little public input to ranking of this factor
Public Policy Concern	° important public policy concern
	TEMPERING CONSIDERATION
Mitigation	° commitment by OWMC to avoid or excavate archaeological resources on any site(s) prior to site development
Certainty of Predictions	° some level of uncertainty regarding potential for other resources on sites
FACTOR RANK: 2	

TABLE B.12

Application of Impact Factor Ranking Criteria For Low Ranked Factors

Ranking Criteria	Ranking
STUDY AREA: Site Vicinity **FACTOR:** Provincial policies and plans	
	MAGNITUDE
Potential for Impact	° potential for impacts that conflict with policies and plans is low
Severity of Impact	° sufficiently removed from areas of concern that impacts expected to be negligible to very minor
Frequency/Duration	° potential long-term impacts
Relationship to Other Factors	° some connection to other land use and social factors
	IMPORTANCE
Significance	° considered to be of low significance
Public Input	° little public input to ranking of this factor; land use considered to be of moderate importance by public
Public Policy Concern	° public policy concern, but no direct conflicts with policies apparent
	TEMPERING CONSIDERATIONS
Mitigation	° possible to mitigate areas of concern through agency discussions, design adjustments and land use controls in site vicinity
Certainty of Predictions	° high level of uncertainty regarding impacts on land use off-site in the future
FACTOR RANK: 2	

TABLE B.12

Application of Impact Factor Ranking Criteria For Low Ranked Factors

Ranking Criteria	Ranking
STUDY AREA: Site Vicinity **FACTOR:** Land use stability	
	MAGNITUDE
Potential for Impact	° impacts will occur
Severity of Impact	° direct impacts to stability due to displacement of uses
Frequency/Duration	° potential long-term impacts
Relationship to Other Factors	° ancillary or secondary factor; should be used to temper other land use, economic, social and agricultural factors rather than as representing major concern by itself
	IMPORTANCE
Significance	° not considered to be of high significance
Public Input	° land use considered to be a moderately important factor
Public Policy Concern	° does not represent a direct conflict with a given agency policy
	TEMPERING CONSIDERATIONS
Mitigation	° limited potential to mitigate; may not be necessary
Certainty of Predictions	° data of limited reliability for use in decision-making, largely due to limited size of study area
FACTOR RANK: 2	

TABLE B.12

Application of Impact Factor Ranking Criteria For Low Ranked Factors

Ranking Criteria	Ranking
STUDY AREA: Site Vicinity **FACTOR:** Rare species	
	MAGNITUDE
Potential for Impact	° species occur around all sites ° probability of impact is likely low
Severity of Impact	° some significant occurrences, but most are already accounted for in SEUs ° no to minor indirect impacts anticipated ° noise, fugitive emissions, sedimentation and changes in drainage pattern and soil moisture regime may occur around the site margin ° for purpose of analysis, all features assumed impacted in site vicinity
Frequency/Duration	° disruption or loss of feature may be long-term, but impacts expected to be infrequent
Relationship to Other Factors	° some overlap with SEU and other natural vegetation features which contain habitat for rare species
	IMPORTANCE
Significance	° significant occurrences, but most are already accounted for in SEUs
Public Input	° natural environment considered to be moderately important by the public
Public Policy Concern	° not an important specific public policy concern
	TEMPERING CONSIDERATIONS
Mitigation	° impacts may be mitigable

TABLE B.12

Application of Impact Factor Ranking Criteria For Low Ranked Factors

Ranking Criteria	Ranking
FACTOR RANK: 2	° many are historic records, present day status is unknown; generally no confirming field work by GLAL ° sensitivity of features is presently unknown ° data base varies among sites depending on level of past investigation by others
STUDY AREA: Site Vicinity **FACTOR:** Fish and wildlife features of significance	
	MAGNITUDE
Potential for Impact	° features occur around most sites
Severity of Impact	° no to minor indirect impacts anticipated ° noise, fugitive emissions, sedimentation and changes in drainage patterns and soil moisture may occur around site margin ° for purpose of analysis, all features assumed lost in site vicinity
Frequency/Duration	° displacement or disruption impacts could be long-term
Relationship to Other Factors	° connected to other biological factors
	IMPORTANCE
Significance	° generally features of local significance which might occur throughout extensive portions of a region ° does not involve rare species ° exclusive of SEUs which are covered under a separate factor, these areas are not deemed significant enough to be designated as SEUs
Public Input	° natural environment considered to be moderately important by public

TABLE B.12

Application of Impact Factor Ranking Criteria For Low Ranked Factors

Ranking Criteria	Ranking
Public Policy Concern	° does not conflict with a specific public policy
	TEMPERING CONSIDERATIONS
Mitigation	° impacts may be mitigable
Certainty of Predictions	° knowledge dependent upon input of others; reports were not field checked
FACTOR RANK: 2	
STUDY AREA: Site Vicinity	
FACTOR: Restraints to dispersion	
	MAGNITUDE
Potential for Impact	° some potential for impacts
Severity of Impact	° minimal restraints to dispersion for all sites; major restraints to dispersion, e.g. Niagara Escarpment addressed during previous site selection stages
Frequency/Duration	° duration of facility operation
Relationship to Other Factors	° some relationship to risk factors where restraints to dispersion would affect exposure
	IMPORTANCE
Significance	° significant restraints avoided in earlier stages of analysis
Public Input	° impacts on the natural environment considered to be moderately important by the public

TABLE B.12

Application of Impact Factor Ranking Criteria For Low Ranked Factors

Ranking Criteria	Ranking
Public Policy Concern	° does not conflict with public policy
	TEMPERING CONSIDERATIONS
Mitigation	° if restraints are determined to be more serious than originally anticipated, can be mitigated through design or operations
Certainty of Predictions	° high certainty that effects would be minor verified by the sensitivity analyses
FACTOR RANK: 2	
STUDY AREA:	Access Roads
FACTOR:	Disruption of operations of community and recreation features (adjacent)
	MAGNITUDE
Potential for Impact	° high likelihood of some impacts
Severity of Impact	° impacts in terms of increased noise levels, image change, potential access constraints and the possibility of evacuation ° impacts low to moderate on local and regional access roads as OWMC traffic generally a small proportion of total volumes projected for routes
Frequency/Duration	° intermittent - during daytime truck delivery only for duration of facility construction and operation
Relationship to Other Factors	° linked to community and regional level indirect impacts
	IMPORTANCE
Significance	° could affect sensitive populations

TABLE B.12

Application of Impact Factor Ranking Criteria For Low Ranked Factors

Ranking Criteria	Ranking
Public Input	° community facilities and services considered to be of relatively low importance by the public
Public Policy Concern	° does not conflict with important public policy
	TEMPERING CONSIDERATIONS
Mitigation	° potentially mitigable on a feature-by-feature basis
Certainty of Predictions	° uncertainty regarding perceived impacts and reactions of users and feature owners to OWMC facility
FACTOR RANK: 2	
STUDY AREA: Community and Regional **FACTOR:** Provincial policies and plans	
	MAGNITUDE
Potential for Impact	° likelihood of impacts is low
Severity of Impact	° sufficiently removed from areas of concern that impacts expected to be negligible to very minor
Frequency/Duration	° potential impacts long-term
Relationship to Other Factors	° little relationship to other factors
	IMPORTANCE
Significance	° considered to be of low significance
Public Input	° little public input to ranking of this factor; land use considered to be of moderate importance by the public

TABLE B.12

Application of Impact Factor Ranking Criteria For Low Ranked Factors

Ranking Criteria	Ranking
Public Policy Concern	° public policy concern, but no direct conflicts with policies apparent
	TEMPERING CONSIDERATIONS
Mitigation	° possible to mitigate areas of concern through agency discussions, design adjustments and land use controls in site vicinity
Certainty of Predictions	° uncertainty exists with regard to future land use decisions
FACTOR RANK: 1	
STUDY AREA: Access Roads	
FACTOR: Disruption of operations of community and recreation features (non-adjacent)	
	MAGNITUDE
Potential for Impact	° low likelihood of impact
Severity of Impact	° indirect impacts expected to be very low to minor ° impacts expected to decrease with distance from facility
Frequency/Duration	° impacts could occur for duration of facility construction and operation, but only during daytime truck delivery hours
Relationship to Other Factors	° some interrelationship with other social and economic factors ° disruption to operation and use of community and recreation features could affect such things as community character and social stability

TABLE B.12

Application of Impact Factor Ranking Criteria For Low Ranked Factors

Ranking Criteria	Ranking
	IMPORTANCE
Significance	° potentially sensitive populations affected
Public Input	° impacts on community facilities and services considered to be of relatively low importance by the public
Public Policy Concern	° no direct conflict with public policy
	TEMPERING CONSIDERATIONS
Mitigation	° impacts may be mitigable
Certainty of Predictions	° some uncertainty with regard to perceived impacts and the response of operators and users to the OWMC facility
FACTOR RANK: 1	

TABLE B.13

Impact Factor Rankings by Consultant

STUDY AREA	FACTOR	CONSULTANTS' RANK (FINAL RANK)
	SOCIAL (out of 1500)	
Site Vicinity	° disruption of day-to-day activities and/or use and enjoyment of property (adjacent to site)	1500 (10)
Site Vicinity	° disruption of day-to-day activities and/or use and enjoyment of property (non-adjacent)	1200 (9)
Site	° displacement of residents	1200 (9)
Access Roads	° disruption of day-to-day activities and/or the use and enjoyment of property (adjacent)	800 (8)
Community and Region	° social stability	800 (8)
Community and Region	° community character	800 (8)
Community and Region	° tourism economy	no ranking (8)
Access Roads	° disruption of use and enjoyment of property and/or day-to-day activities (non-adjacent)	600 (7)
Community and Region	° tourism operations	no ranking (6)
Community and Region	° social cohesion	400 (6)
Site Vicinity	° disruption of operations of community and recreation features (adjacent)	300 (5)

TABLE B.13

Impact Factor Rankings by Consultant

STUDY AREA	FACTOR	CONSULTANTS' RANK (FINAL RANK)
Site	° displacement of community, recreation and historic features	200 (3)
Site Vicinity	° disruption of operations of community and recreation features	200 (3)
Access Roads	° disruption of operations of community and recreation features (adjacent)	150 (2)
Access Roads	° disruption of community and recreation features (non-adjacent)	100 (1)
	LAND USE (out of 30)	
Site Vicinity	° existing land use	30 (8)
Site	° planned and proposed land use	25 (7)
Site Vicinity	° planned and proposed land use	25 (7)
Site	° existing land use	20 (6)
Community and Regional	° existing land use	10 (4)
Community and Regional	° planned and proposed land use	10 (4)
Access Roads	° existing land use	10 (4)
Access Roads	° planned and proposed land use	10 (4)

TABLE B.13

Impact Factor Rankings by Consultant

STUDY AREA	FACTOR	CONSULTANTS' RANK (FINAL RANK)
Site Vicinity	° land use stability	5 (3)
Site Vicinity	° provincial policies and plans	2 (2)
Site	° land use stability	2 (2)
Community and Regional	° provincial policies and plans	1 (1)
	AGRICULTURAL RESOURCES (out of 5)	
Site Vicinity	° disruption of adjacent farm operations	5 (10)
Community and Regional	° stability of farm population	5 (9)
Site Vicinity	° disruption of non-adjacent farm operations	4 (9)
Site Vicinity	° partial displacement of farms	4 (9)
Community and Regional	° stability of agricultural land base	4 (8)
Community and Regional	° disruption to the farm economy	4 (8)
Access Roads	° disruption to farm traffic and cattle crossings	4 (8)
Site	° loss of farmland	3 (6)

TABLE B.13

Impact Factor Rankings by Consultant

STUDY AREA	FACTOR	CONSULTANTS' RANK (FINAL RANK)
Site	° displacement of farms with on-site headquarters	3 (6)
Access Roads	° disruption to crop and livestock production	2 (4)
	NATURAL ENVIRONMENT (out of 5)	
Site	° rare species	4 (8)
Site	° potential for occurrence of other significant biological features	3 (6)
Site	° natural vegetation displaced	2 (4)
Site Vicinity	° significant environmental units	2 (4)
Access Roads	° fish communities	2 (4)
Site Vicinity	° other natural vegetation	2 (3)
Site Vicinity	° rare species	1 (2)
Site Vicinity	° fish and wildlife features of significance	1 (2)
	ECONOMIC (out of 5)	
Site Vicinity	° regional and community economic base	4 (8)

TABLE B.13

Impact Factor Rankings by Consultant

STUDY AREA	FACTOR	CONSULTANTS' RANK (FINAL RANK)
Site Vicinity	° land value impacts	3 (7)
Site Vicinity	° business activities negatively affected by the presence of OWMC facilities	3 (6)
Site Vicinity	° municipal finance	3 (6)
Site Vicinity	° business activities positively affected by the presence of OWMC facilities	2 (4)
Site	° displacement of businesses	2 (4)
	AIR DISPERSION/AIR QUALITY (out of 5)	
Site Vicinity	° existing and anticipated air quality	2.3 (6)
Site Vicinity	° restraints to dispersion	1 (2)
	ARCHAEOLOGY	
Site Vicinity	° archaeological resources	no ranking (2)

TABLE B.14

Reasons for Placing Factors in High Impact Factor Grouping

FACTOR	REASONS FOR PLACEMENT IN HIGH IMPORTANCE FACTOR GROUPING
Site	
Displacement of residents	o direct severe impact on individuals involved; o potential displacement of significant populations; o relocation can affect people for many years; o connections to other social and land use factors in site vicinity and at community level; o may not be possible to mitigate all impacts; o highly ranked factor by public.
Rare species	o permanent resource loss; o connections to other natural environmental impact; o potentially significant resource; o highly ranked factor by public; o significant agency concern; o may not be possible to mitigate or predict outcome of mitigation.
Site Vicinity	
Disruption of day-to-day activities and/or use and enjoyment of property (adjacent)	o some noise and visual impacts will occur; o potentially serious impacts; o represents a broad range of social, economic and land use concerns; o potentially includes sensitive population; o highly ranked factor by public o may not be fully mitigable; o potential for serious unanticipated impacts.

TABLE B.14

Reasons for Placing Factors in High Impact Factor Grouping

FACTOR	REASONS FOR PLACEMENT IN HIGH IMPORTANCE FACTOR GROUPING
Site Vicinity - Cont'd	
Disruption of adjacent farm operations	o potentially serious impacts for individual operations; o direct and long-term impacts; o highly interrelated to other factors; o considered as important factor by the public; o impacts not fully mitigable.
Disruption of day-to-day activities and/or of use and enjoyment of property (non-adjacent)	o moderate levels of impacts expected further from site; o long-term impacts; o representative of a range of other impacts; o considered to be highly important by public but less so than adjacent residents; o not fully mitigable.
Disruption of non-adjacent farm operations	o moderate levels of impact expected further from site; o long-term impacts; o connected to a range of other impacts; o considered to be highly important by public but less so than adjacent farm operations; o not fully mitigable.
Partial displacement of farms	o could have significant impact on viability of operations; o direct impacts on individuals; o impacts may be long-term; o considered to be highly important factor by public but less so than adjacent residents; o loss of foodlands is considered to be an important public policy concern.

TABLE B.14

Reasons for Placing Factors in High Impact Factor Grouping

FACTOR	REASONS FOR PLACEMENT IN HIGH IMPORTANCE FACTOR GROUPING
Site Vicinity - Cont'd	
Existing land use	o impacts potentially severe; o impacts potentially long-term; o plays an overview role supplementary to other factors; o limited potential to mitigate.
Community and Region	
Stability of farm population	o disruption to the local agricultural community expected to be limited but potential for serious unanticipated impacts due to role of perception; o effects likely to be medium term; o connections to a wide range of other factors; o important area of community concern; o little opportunity for mitigation.
Social stability	o indirect impacts and largely perceived impacts expected; o potential long-term impacts; o connections to a wide range of other factors; o considered by public to be important but not considered to be as important as direct impact measures; o limited mitigation possible.
Community character	o indirect impacts partially based on voluntary decisions of householders; o although impacts expected to be relatively minor to moderate; o potential for more severe impacts than anticipated because of role of perception.

TABLE B.14

Reasons for Placing Factors in High Impact Factor Grouping

FACTOR	REASONS FOR PLACEMENT IN HIGH IMPORTANCE FACTOR GROUPING
Community and Region - Cont'd	
Community Character	o potentially long-term effects; o connections to a wide range of other factors; o considered by public to be important but not as important as direct impacts; o limited mitigation possible.
Stability of agricultural land base	o potential impacts likelihood and severity partially based on voluntary decisions of farm operators; o potential for more severe impacts than anticipated because of role of perception; o potential for long-term impacts; o impacts are interconnected with other important factors; o limited mitigation possible.
Regional and community economic base	o direct and indirect and mainly positive impacts are possible; o could result in long-term impacts; o affects a wide range of other factors; o limited potential to decrease negative impacts.
Disruption to the farm economy	o effects from emissions on crops and livestock expected to be low but some uncertainty regarding perceived effects; o potential long-term impacts; o connection to many other factors.

TABLE B.14

Reasons for Placing Factors in High Impact Factor Grouping

FACTOR	REASONS FOR PLACEMENT IN HIGH IMPORTANCE FACTOR GROUPING
Community and Region - Cont'd	
Tourism economy	o impacts expected to e minor but potential for more severe impacts than anticipated because of role of perception; o potential for long-term impacts; o relationship to other economic factors; o perceived as important factor by public.
Access Roads	
Disruption of day-to-day activities and/or the use and enjoyment of property (adjacent)	o impacts expected to be minor to moderate but role of perception may increase impacts; o potential long-term impacts; o impacts are interconnected to many other factors.
Disruption of farm traffic and cattle crossings	o impacts expected to be moderate or greater; o long-term impacts; o affects other agricultural factors; o limited mitigation possible.

TABLE B.15

Reasons for Placing Factors in Low Impact Factor Grouping

FACTOR	REASONS FOR PLACEMENT IN LOW IMPORTANCE FACTOR GROUPING
Site	
Land use stability	o ancillary or secondary factor; use to temper other land use, economic, social and agricultural factors; o not considered to be of high significance; o data of limited reliability for decision-making.
Archaeological resources	o permanent displacement or disruption of an important resource is possible but high potential for and commitment to mitigate; o little relationship to other factors.
Site Vicinity	
Rare species	o probability of impacts - low; o no to minor indirect impacts anticipated; o limited certainty of predictions.
Provincial policies and plans	o potential for impacts is low and impacts expected to be negligible; o possible to mitigate areas of concern.
Fish and wildlife features of significance	o no to minor indirect impacts anticipated; o features do not involve rare or endangered species or SEUs; o impacts may be mitigable.

TABLE B.15

Reasons for Placing Factors in Low Impact Factor Grouping

FACTOR	REASONS FOR PLACEMENT IN LOW IMPORTANCE FACTOR GROUPING
Site Vicinity (Cont'd)	
Restraints to dispersion	o minimal restraints to dispersion for all sites; o significant restraints avoided at earlier stages of analysis; o potential for mitigation if unanticipated restraints identified; o high certainty of predictions.
Community and Region	
Provincial policies and plans	o likelihood of impacts is low; o impacts expected to be negligible; o little relationship to other factors; o possible to mitigate areas of concern.
Access Roads	
Disruption of operations of community and recreation features (adjacent)	o impacts expected to be low and potentially mitigable.
Disruption of operations of community and recreation features (non-adjacent)	o low likelihood of impact; o indirect impacts expected to be very low to minor and to decrease with distance from the facility; o impacts may be mitigable.

Final report

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SITE SELECTION PROCESS
PHASE 4A: SELECTION OF A PREFERRED SITE(S)
SITE SELECTION
VOLUME 2 - TECHNICAL APPENDICES - PART 2

June, 1986

This document consists of the Technical Appendices which accompany Chapters 5 to 9 of Volume 2 of Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Site Selection. Chapters 5 to 9 are bound as Part 2 of Volume 2.

SITE SELECTION PROCESS

PHASE 4A: SELECTION OF A PREFERRED SITE(S)

Volume 2 - Technical Appendices - Part 2

Volume 2 Chapter	Appendix
5.0 Differences and Tradeoffs Synthesis	C
6.0 Synthesis of Disciplinary Perspectives	D, E
7.0 Quantitative Aggregation of Factors	F
8.0 Sensitivity Analyses	G, H, I

APPENDIX C

(Appendix to Chapter 5)

APPENDIX C

INTRODUCTION

Appendix C consists of the following tables:

- Table C.1 - Summary of Factor Suitability Levels - LF-4N/PI-1N
- Table C.2 - Summary of Factor Suitability Levels - LF-4N/PI-13N
- Table C.3 - Summary of Factor Suitability Levels - LF-3C
- Table C.4 - Summary of Factor Suitability Levels - LF-9C
- Table C.5 - Summary of Factor Suitability Levels - LF-1E
- Table C.6 - Summary of Factor Suitability Levels - LF-1E/PI-27E
- Table C.7 - Response to Concerns Raised by the Public and Agencies Through Submissions and Meetings
- Table C.8 - Issues Raised in Site Selection by the Public and Agencies - Relationship to Site Selection Factors and Frequency of Occurrence
- Table C.9 - Issues Raised by Public and Agencies Relating to Mitigation/Compensation
- Table C.10 - Issues Raised by Public and Agencies Not Related to a Specific Factor
- Table C.11 - Rationale for Major Risks or Impacts - LF-4N/PI-1N
- Table C.13 - Rationale for Major Risks or Impacts - LF-4N/PI-13N
- Table C.13 - Major Risk Differences - LF-4N/PI-1N vs. LF-4N/PI-13N
- Table C.14 - Major Impact Differences - LF-4N/PI-1N vs. LF-4N/PI-13N
- Table C.15 - Rationale for Major Risks or Impacts - LF-3C
- Table C.16 - Rationale for Major Risks or Impacts - LF-9C
- Table C.17 - Major Risk Differences - LF-9C vs. LF-3C
- Table C.18 - Major Impact Differences - LF-9C vs. LF-3C
- Table C.19 - Rationale for Major Risks or Impacts - LF-1E
- Table C.20 - Rationale for Major Risks or Impacts - LF-1E/PI-27E
- Table C.21 - Major Risk Differences - LF-1E vs. LF-1E/PI-27E

- Table C.22 - Major Impact Differences - LF-1E vs. LF-1E/PI-27E
- Table C.23 - Major Risk Differences - LF-9C vs. LF-4N/PI-1N
- Table C.24 - Major Impact Differences - LF-9C vs. LF-4N/PI-1N
- Table C.25 - Major Risk Differences - LF-4N/PI-1N vs. LF-1E/PI-27E
- Table C.26 - Major Impact Differences - LF-4N/PI-1N vs. LF-1E/PI-27E
- Table C.27 - Major Risk Differences - LF-9C vs. LF-1E/PI-27E
- Table C.28 - Major Impact Differences - LF-9C vs. LF-1E/PI-27E
- Table C.29 - Major Risk Differences - LF-9C vs. LF-1E
- Table C.30 - Major Impact Differences - LF-9C vs. LF-1E

Tables C.1 to C.6 provide a summary of the factor suitability levels employed in the differences and tradeoffs synthesis (Chapter 5). A rationale is provided for each of the factor suitability levels.

Table C.7 presents the concerns raised by the public and agencies in Phase 4A. A response regarding the treatment of these concerns is provided. This table contains a rationale for cases where a concern was not considered in Phase 4A.

Table C.8 contains a listing of concerns raised by the public and agencies and the frequency with which they were raised. Tables C.9 and C.10 list the frequency of concerns raised by the public and agencies relating to mitigation/compensation and those not related to a specific factor, respectively.

Tables C.11, C.12, C.15, C.16, C.19 and C.20 provide the rationale for the major risks and impacts for each siting option. An explanation of how these major risks and impacts were identified is provided in Section 5.2.3 in Chapter 5.

The remaining tables present the major risk and impact differences for each siting option paired comparison. Factor ranks and factor suitability levels are provided. The magnitude and significance of the differences is also provided. Section 5.2.4 in Chapter 5 explains how these differences were identified and tabulated.

TABLE C.1

Summary of Factor Suitability Levels

Siting Option - LF-4M/PI-1M

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
	A. **RISK**			
	• **Transportation**	• province-wide hazard-based spill index of OWMC generated transport	-3.0	• moderate annual non-accident related spills and low annual accident related spills - relative to the other siting options
		• province-wide accident involvements of OWMC generated transport	-1.8	• low annual accident involvement relative to the other siting options
		• transportation risks on local and regional access roads due to accident involvements of OWMC generated transport	-1.1	• moderately low risk to road users relative to the other siting options
		• transportation risks on local and regional access roads due to hazard-based spills of OWMC generated transport	-0.9	• low risk to population and sensitive uses; moderately low risk to road users and sensitive hydrogeologic lands and moderate surface water suitability relative to the other siting options
	• **Air Quality**	• risk from direct inhalation of emissions - chronic	-4.1	• relatively low population exposure - incinerator stack emissions; high future population exposure - fugitive emissions; high population exposure - fugitive emissions; high future population exposure - incinerator stack emissions
		• risk from direct inhalation of emissions - acute	-5.0	• high level of topographic features on or around the siting option; relatively low population exposure - upset emissions from incinerator stack emissions; low population exposure - upset emissions from low elevation sources; low future population exposure - upset emissions from incinerator stack; relatively low future population exposure - upset emissions from low elevation sources; high distribution of community facilities

TABLE C.1

Summary of Factor Suitability Levels

Siting Option - LF-4H/PI-1N

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
	A. RISK - (Cont'd)			
	• Air Quality	• risks from ingestion of cistern and pond water	-1.4	• low exposure from cistern and pond water - incinerator stack emissions; low exposure from cistern and pond water - fugitive emissions
		• risks from consumption of crops and livestock	-3.1	• low sensitive crop exposure - incinerator stack emissions; high sensitive crop exposures - fugitive emissions; low sensitive livestock emissions - incinerator stack emissions; low sensitive livestock exposures - fugitive emissions; low future sensitive crop exposures - incinerutor stack emissions; high future sensitive crop exposures - fugitive emissions; low future sensitive livestock exposures - incinerator stack emissions; low future sensitive livestock exposures - fugitive emissions
	• Hydrogeologic Suitability	• capability of providing natural containment	-5.0	• confining layer is uniform and laterally and vertically continuous at both sites; confining layer is thin at both sites resulting relatively rapid breakthrough times (GLAL, 1985b)
		• ground water use	-5.0	• ground water supplies may be developed in granular aquifers sufficiently removed from the sites to be unaffected; aquifer at LF-4H may be capable of meeting more demanding water use requirements; aquifer use at PI-1N is limited primarily to domestic and agricultural requirements (GLAL, 1985b)
	• Surface Water Suitability	• susceptibility of site to flooding	-3.0	• middle level of relative constraint due to proximity of significant floodplain of Indian Creek (GLAL, 1985c)
		• potential for water use interference	-2.5	• no potable uses immediately downstream of site and high downstream surface water use index; middle level of relative suitability (GLAL, 1985c)

TABLE C.1

Summary of Factor Suitability Levels

Siting Option - LF-4N/PI-1N

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
SITE	B. ENVIRONMENTAL IMPACTS			
	• Residents	• displacement of residents	-3.1	• third most impacted option; third highest number of residents displaced (IER, 1985a)
	• Businesses	• displacement of businesses	-2.2	• moderate number of businesses displaced; estimated annual sales ($709,000 million) and number of employees are moderately low (Clayton, 1985a)
	• Community and Recreation Features	• displacement of historical, community and recreation features	-5.0	• one existing and one proposed feature displaced
		• archaeological resources[1]	-	
	• Land Use	• existing land use	-2.6	• has a moderate number of residences; no commercial or industrial facilities/uses on site (LKA, 1985)
		• proposed and planned land uses	-4.7	• has generally agricultural land use designations (high constraint) which are partially offset by the sanitary landfill designation on LF-4N which may accommodate the landfill facility; policies and zoning are protective of agricultural land (LKA, 1985)
		• land use stability	-3.0	• high proportion of lands under absentee ownership (moderately low constraint); no land sales; a high proportion of good quality buildings (LKA, 1985)

[1] Factor suitability levels not developed for archaeological resources

TABLE C.1

Summary of Factor Suitability Levels

Siting Option - LF-4N/PI-1N

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
SITE	B. ENVIRONMENTAL IMPACTS - (Cont'd)			
	• Agricultural Resources	• displacement of farms with on-site headquarters	-2.3	• moderately few numbers of operations with headquarters; 2 are owned, 1 is leased; average size is moderately low; estimated gross farm revenue is moderate (Ecologistics, 1985)
		• loss of farmland	-5.0	• Class 1 equivalent rating is high; no tile drainage on-site (Ecologistics, 1985)
	• Natural Environment	• rare species	-3.0	• medium potential impact on rare plant and animal species (GLAL, 1985a)
		• natural vegetation displaced	-1.0	• 36 ha displaced (GLAL, 1985a)
		• potential for occurrence of other significant features	-1.0	• low potential at both LF-4N and PI-1N; low potential in Halton for finding additional high significance resources (GLAL, 1985a)

TABLE C.1

Summary of Factor Suitability Levels

Siting Option - LF-4N/PI-1N

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
SITE VICINITY	B. **ENVIRONMENTAL IMPACTS** - (Cont'd)			
	• **Residents**	• property value impacts	-3.9	• moderately high degree of negative property value impacts ($1,487,000) within the site vicinity (Clayton, 1985a)
		• disruption of day-to-day activities and/or the use and enjoyment of property (adjacent to site)	-4.3	• second most impacted option; second highest number of residents live adjacent; second highest number of people who are home during the day (IER, 1985a)
		• disruption of day-to-day activities and/or the use and enjoyment of property (non-adjacent)	-5.0	• most impacted option; most residents in the nighttime noise zone; second most in the daytime noise zone; second most impacted in terms of overall visual intrusion (IER, 1985a)
	• **Businesses**	• business activities negatively affected by the presence of OWMC facilities	-2.6	• number of businesses negatively affected are high; number of employees are moderate; annual sales ($1,473,000) are moderately low (Clayton, 1985a)
		• business activities positively affected by the presence of OWMC facilities	+0.4	• few businesses and employees positively affected; annual sales are moderately low (Clayton, 1985a)
	• **Community and Recreation Features**	• disruption of operations of community and recreation features (adjacent to site)	-2.5	• one feature adjacent (IER, 1985a)
		• disruption of operations of community and recreation features (site vicinity)	-2.7	• fourth most impacted option; second highest number of features and number of sensitive features within the site vicinity; one feature in the noise impact zone (IER, 1985a)

TABLE C.1

Summary of Factor Suitability Levels

Siting Option - LF-4N/PI-1N

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
SITE VICINITY	B. **ENVIRONMENTAL IMPACTS** - (Cont'd)			
	• **Land Use**	• existing land use	-3.3	• moderate number of residences and proportion of residential land uses; lower residential density than LF-1E (LKA, 1985)
		• proposed and planned land use	-5.0	• primarily designated agricultural with some significant residential clusters; no industrial lands; official plan policies are protective of agricultural lands and permit some residential infilling; moderate numbers of vacant lots of record (LKA, 1985)
		• land use stability	-1.9	• substantial proportions of lands under absentee ownership (low constraint); several recent land sales, severe fluctuations in land value (low constraint) and a high proportion of buildings of high quality (high constraint) (LKA, 1985)
		• provincial policies and plans	-5.0	• may impact both Parkway Belt West Plan (public and open space uses near PI-1N) and Niagara Escarpment Plan (escarpment protection and complementary uses near LF-4N), both being moderate constraints (LKA, 1985)
	• **Agricultural Resources**	• partial displacement of farms (off-site farms with on-site land)	-4.4	• number of farms with headquarters losing on-site land is high; average parcel size lost is moderately high; no on-site owned land is lost by these farms; a moderate amount of rented land is lost (Ecologistics, 1985)
		• disruption of adjacent farm operations	-3.4	• moderately high number of headquartered farms and operators with owned land are in the vicinity; livestock density is moderately low (Ecologistics, 1985)
		• disruption of non-adjacent farm operations	-3.2	• number of farm operations with headquarters and livestock density are moderate; proportion of non-adjacent vicinity in crops is moderately high (Ecologistics, 1985)

TABLE C.1

Summary of Factor Suitability Levels

Siting Option - LF-4N/PI-1N

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
SITE VICINITY	B. **ENVIRONMENTAL IMPACTS** - (Cont'd)			
	• **Natural Environment**	• significant environmental units (SEUs)	-1.0	• approximately 140 ha (GLAL, 1985a)
		• fish and wildlife features of significance	-1.0	• 1 feature (GLAL, 1985a)
		• other natural vegetation	-1.0	• approximately 245 ha, fourth lowest area of all siting options (GLAL, 1985a)
		• rare species	-3.0	• medium potential impact on rare plant species (GLAL, 1985a)
	• **Air Dispersion/ Air Quality**	• restraints to dispersion	-5.0	• wind channelling possible at both sites due to break in Niagara Escarpment; possible increased levels of turbulence in the wake of the Escarpment (ORF, 1985)
		• existing and anticipated air quality	-3.3	• low constraint existing air quality; low constraint existing short-term air quality; high estimated effect on air quality - incinerator stack emissions; high estimated effect on air quality - fugitive emissions

TABLE C.1

Summary of Factor Suitability Levels

Siting Option - LF-4N/PI-1N

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
COMMUNITY AND REGIONAL	B. **ENVIRONMENTAL IMPACTS** - (Cont'd)			
	• **Community and Regional**	• municipal finance	+0.2	• impact of payment-in-lieu of taxes made by OWMC is much less because of unusual municipal tax levy situation; option requires two sites, greater reduced property taxes due to negative property value impacts
		• social stability	-3.4	• potentially least impacted option; second lowest level of existing stability; potential disruption through resident displacement is moderately high; option has least potential for disruption through resident out-migration (IER, 1985a)
		• social cohesion	-2.2	• second least impacted siting option; second lowest potential for disruption through resident displacement; lowest potential for voluntary out-migration (IER, 1985a)
		• community character	-4.8	• second most impacted option; second most impacted with respect to compatibility with land use, heritage feature and visual compatibility (IER, 1985a)
		• community and regional economic base	+2.6	• number of new jobs created and households generated are moderate; perception among community businesses primarily negative on possible effects of the facilities (Clayton, 1985a)
		• tourism economy	-0.5	• some impact on tourism economy (Appendix E, Volume II)
		• tourism operations	-1.0	• some impact on tourism operations (Appendix E, Volume II)

TABLE C.1

Summary of Factor Suitability Levels

Siting Option - LF-4N/PI-1N

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
COMMUNITY AND REGIONAL	B. **ENVIRONMENTAL IMPACTS** - (Cont'd)			
	• **Land Use**	• existing land use	-5.0	• has primarily agricultural land use pattern with some significant residential areas in the region, but no compatible industrial lands (LKA, 1985)
		• proposed and planned land use	-5.0	• has predominantly agricultural land use designation with some residential clusters; no industrial lands; official plan policies protect agricultural lands and may permit significant urban residential development in Milton area and infilling of rural residential clusters (LKA, 1985)
		• provincial policies and plans	-5.0	• has Parkway Belt West Plan lands providing for public and open space uses and Niagara Escarpment Plan lands near LF-4N providing for escarpment protection, complementary uses and minor settlement areas (moderately high constraint) (LKA, 1985)
	• **Agricultural Resources**	• stability of farm population	-4.4	• moderately high proportion of farmers under age of 55, as well as proportion of full-time operators (Ecologistics, 1985)
		• stability of agricultural land base	-4.1	• percent of land in large parcels is high; owned farmland is moderate and area farmed is moderately high; Class 1 equivalents are rated high; farm residences as a proportion of total residences is moderate; amount of private land ownership is high (Ecologistics, 1985)
		• disruption to the farm economy	-3.5	• gross farm revenue is moderately low; fugitive stack exposure to livestock indices are high; crop indices for fugitive and stack emissions are moderate and moderately low, respectively (Ecologistics, 1985)

TABLE C.1

Summary of Factor Suitability Levels

Siting Option - LF-4N/PI-1N

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
ACCESS ROADS	B. ENVIRONMENTAL IMPACTS - (Cont'd)			
	• Residents	• disruption of day-to-day activities and/or the use and enjoyment of property (adjacent)	-2.1	• third most impacted option; third highest number of age sensitive residents and the fourth highest number of residents adjacent to the access route (IER, 1985a)
		• disruption of day-to-day activities and/or the use and enjoyment of property (vicinity)	-1.2	• fourth most impacted option; fourth highest number of residents within the noise impact zone; fourth highest number of residents within the vicinity (IER, 1985a)
	• Community and Recreation Features	• disruption of operations of community and recreation features (adjacent)	-4.1	• second most impacted option; second highest number of features adjacent; second highest number of sensitive features adjacent (IER, 1985a)
		• disruption of operations of community and recreation features (vicinity)	-4.6	• second most potentially impacted option; third highest number of features and sensitive feature in the access route vicinity; second highest number of features and highest number of sensitive features within the noise impact zone (IER, 1985a)
	• Land Use	• existing land uses	-3.3	• moderate number of residences and commercial facilities; high proportion of residential land use along the access roads (LKA, 1985)
		• planned and proposed land uses	-4.9	• route travels through rural/agricultural area with substantial amounts of residentially designated land; policies protect agricultural land; high proportion of unapproved development proposals, but fewer vacant lots of record compared with West Lincoln access roads (LKA, 1985)
	• Agricultural Resources	• disruption to the farm traffic and cattle crossings	-3.0	• agricultural vehicle impact index is moderately high on local roads and moderately low on regional roads; number of customer stops are moderate along all roads; low number of cattle crossing occurring on local roads (Ecologistics, 1985)

TABLE C.1

Summary of Factor Suitability Levels

Siting Option - LF-4N/PI-1N

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
ACCESS ROADS	B. **ENVIRONMENTAL IMPACTS** - Cont'd			
	• **Agricultural Resources**	• disruption to crop and livestock production	-1.4	• adjacent crops receive a moderately high rating; adjacent land downstream livestock are rated moderately low (Ecologistics, 1985)
	• **Natural Environment**	• fish communities	-5.0	• high constraint level for regionally significant fisheries (GLAL, 1985a)

TABLE C.2

Summary of Factor Suitability Levels

Siting Option - LF-4N/PI-13N

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
	A. **RISK**			
	• Transportation	• province-wide hazard-based spill index of OWMC generated transport	-3.0	• moderate annual non-accident-related spills relative to the other siting options; low annual accident related spills relative to the other siting options
		• province-wide accident involvements of OWMC generated transport	-1.8	• low annual accident involvement relative to the other siting options
		• transportation risks on local and regional access roads due to accident involvements of OWMC generated transport	-1.0	• moderately low risk to road users relative to the other siting options
		• transportation risks on local and regional access roads due to hazard-based spills of OWMC generated transport	-0.7	• low risk to population, road users, sensitive uses and sensitive hydrogeologic lands and moderate surface water suitability, relative to the other siting options
	• Air Quality	• risk from direct inhalation of emissions - chronic	-4.8	• high population exposure - incinerator stack emissions; high population exposure - fugitive emissions; high future population exposure - incinerator stack emissions; high future population exposure - fugitive emissions
		• risk from direct inhalation of emissions - acute	-5.0	• high level of topographic features on or around the siting option; low relative population exposure - upset emissions from incinerator stack; high relative population exposure - upset emissions from low elevation sources; low relative future population exposure - upset emission from incinerator stack; high relative future population exposure - upset emission from low elevation sources; low distribution of community facilities

TABLE C.2

Summary of Factor Suitability Levels

Siting Option - LF-4N/PI-13N

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
	A. **RISK** - (Cont'd)			
	• **Air Quality**	• risks from ingestion of cistern and pond water	-1.8	• low relative exposure from cistern and pond water - incinerator stack emissions; low exposure from cistern and pond water - fugitive emissions
		• risks from consumption of crops and livestock	-3.2	• low sensitive crop exposure - incinerator stack emission; high sensitive crop exposure - fugitive emissions; low sensitive livestock exposures - incinerator stack emissions; low sensitive livestock exposures - fugitive emissions; low future sensitive crop exposures - incinerator stack emissions; high future sensitive crop exposure - fugitive emissions; low future sensitive livestock exposures - incinerator stack emissions; low future sensitive livestock exposures - fugitive emissions
	• **Hydrogeologic Suitability**	• capability of providing natural containment	-6.0	• confining layer is uniform and laterally and vertically continuous at LF-4N and is discontinuous at PI-13N due to erosion; confining layer is thin at both sites and discontinuous at PI-13N, resulting in ly rapid breakthrough times (GLAL, 1985b)
		• ground water use	-5.0	• suitability rating reflects the absence of a suitable alternative source of ground water supply in the vicinity of PI-13N; alternative supplies exist in the vicinity of LF-4N; aquifer at LF-4N may be capable of meeting more demanding water use requirements; aquifer use at PI-13N is limited to domestic and agricultural requirements (GLAL, 1985b)
	• **Surface Water Suitability**	• susceptibility of site to flooding	-2.7	• middle level of relative constraint due to proximity of significant floodplain of Indian Creek (GLAL, 1985c)
		• potential for water use interference	-5.0	• highest level of constraint due to location of potable uses immediately downstream from the site and high downstream surface water use index (GLAL, 1985c)

TABLE C.2

Summary of Factor Suitability Levels

Siting Option - LF-4N/PI-13N

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
SITE	B. ENVIRONMENTAL IMPACTS			
	• Residents	• displacement of residents	-3.1	• fourth most impacted; fourth highest number of residents displaced, slightly less impacted than LF-4N/PI-1N (IER, 1985a)
	• Businesses	• displacement of businesses	-1.2	• there are few businesses displaced; estimated annual sales (269,000) and number of employees displaced are low (Clayton, 1985a)
	• Community and Recreation Features	• displacement of historical, community and recreation features	-4.0	• two historic buildings are located on LF-4N/PI-1N, one of which is designated under the Ontario Heritage Act
		• archaeological resources[1]	-	
	• Land Use	• existing land use	-2.6	• has a moderate number of residences, no commercial or industrial facilities/uses on-site (LKA, 1985)
		• proposed and planned land uses	-4.3	• has generally agricultural land use designations (high constraint) which are partially offset by the sanitary landfill designation on LF-4N which may accommodate the landfill facility; policies and zoning are protective of agricultural land; fewer vacant lots of record than LF-4N/PI-1N (LKA, 1985)
		• land use stability	-2.1	• has highest proportion of site area under absentee ownership, with no land sales and a relatively low percentage of on-site buildings in good condition, indicating the lowest overall level of stability are hence, the lowest level of constraint (LKA, 1985)

[1] Factor suitability levels not developed for archaeological resources

TABLE C.2

Summary of Factor Suitability Levels

Siting Option - LF-4N/PI-13N

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
SITE	B. ENVIRONMENTAL IMPACTS - (Cont'd)			
	• Agricultural Resources	• displacement of farms with on-site headquarters	-5.0	• moderately low number of headquartered farms, half owned, half rented; rented farm size is high; estimated gross farm revenue is high (Ecologistics, 1985)
		• loss of farmland	-4.9	• Class 1 equivalent rating is high; no tile drainage (Ecologistics, 1985)
	• Natural Environment	• rare species	-3.0	• medium potential impact on rare species (GLAL, 1985a)
		• natural vegetation displaced	-1.0	• approximately 30 ha displaced (GLAL, 1985a)
		• potential for occurrence of other significant features	-1.0	• low potential on LF-4N; low potential on PI-13N, site is farmed (GLAL, 1985a)

TABLE C.2

Summary of Factor Suitability Levels

Siting Option - LF-4N/FI-13N

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
SITE VICINITY	B. ENVIRONMENTAL IMPACTS - (Cont'd)			
	• Residents	• property value impacts	-5.0	• high degree of negative property value impacts ($1,912,000) within the site vicinity (Clayton, 1985a)
		• disruption of day-to-day activities and/or the use and enjoyment of property (adjacent to site)	-5.0	• most impacted; greatest number of residents live adjacent; greatest number of people at home during the day (IER, 1985a)
		• disruption of day-to-day activities and/or the use and enjoyment of property (non-adjacent)	-5.0	• second most impacted; most potentially impacted in terms of visual intrusion; largest number of residents in the site vicinity (IER, 1985a)
	• Businesses	• business activities negatively affected by the presence of OWMC facilities	-5.0	• number of businesses negatively affected is comparatively high; annual sales ($4,318,000) and number of employees are high (Clayton, 1985a)
		• business activities positively affected by the presence of OWMC facilities	+0.6	• few businesses and employees positively affected; annual sales are moderately low (Clayton, 1985a)
	• Community and Recreation Features	• disruption of operations of community and recreation features (adjacent to site)	-5.0	• potentially most impacted; 2 features adjacent (IER, 1985a)
		• disruption of operations of community and recreation features (site vicinity)	-2.8	• third potentially most impacted; one feature in the noise impact zone; second highest number of features in the site vicinity; highest number of sensitive features in the site vicinity (IER, 1985a)

TABLE C.2

Summary of Factor Suitability Levels

Siting Option - LF-4N/PI-13N

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
SITE VICINITY	B. **ENVIRONMENTAL IMPACTS** - (Cont'd)			
	• **Land Use**	• existing land use	-5.0	• greatest number of residences within 1000 m and within the site vicinity; greatest number of commercial facilities (LKA, 1985)
		• proposed and planned land use	-5.0	• primarily designated agricultural with some significant residential clusters; no industrial lands; official plan policies are protective of agricultural lands and permit some residential infilling; moderate numbers of vacant lots of record (LKA, 1985)
		• land use stability	-1.4	• has substantial proportion of lands under absentee ownership, several recent land sales; severe fluctuations in land value and a high proportion of buildings of good quality (high constraint); significant more land sales, indicating somewhat less stability than LF-4N/PI-1N (LKA, 1985)
		• provincial policies and plans	-3.3	• Parkway Belt West Plan lands providing for public and open space uses for transportation uses near PI-13N (opportunity) and Niagara Escarpment Plan lands near LF-4N providing for escarpment protection and complementary use areas (moderate constraint) (LKA, 1985)
	• **Agricultural Resources**	• partial displacement of farms (off-site farms with on-site land)	-3.0	• low number of off-site farms with headquarters losing on-site land; average parcel size lost is high; no owned land lost by off-site farms (Ecologistics, 1985)
		• disruption of adjacent farm operations	-5.0	• number of farms with headquarters is high; number of operators with owned land is high; livestock density is moderate (Ecologistics, 1985)
		• disruption of non-adjacent farm operations	-3.3	• moderate number of farms with headquarters; proportion of non-adjacent vicinity in crops is moderately high; livestock density is moderately low (Ecologistics, 1985)

TABLE C.2

Summary of Factor Suitability Levels

Siting Option - LF-4N/PI-13N

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
SITE VICINITY	**B. ENVIRONMENTAL IMPACTS - (Cont'd)**			
	• Natural Environment	• significant environmental units (SEUs)	-1.0	• second lowest area of all siting options, c. 94 ha (GLAL, 1985a)
		• fish and wildlife features of significance	-1.0	• 1 feature (GLAL, 1985a)
		• other natural vegetation	-3.0	• approximately 291 ha (GLAL, 1985a)
		• rare species	-5.0	• high potential impact on rare plant species (GLAL, 1985a)
	• Air Dispersion/ Air Quality	• restraints to dispersion	-3.0	• wind channelling possible due to break in Niagara Escarpment (less at PI-13N than at PI-1N); possible increased levels of turbulence in the wake of the escarpment at LF-4N (ORF, 1985)
		• existing and anticipated air quality	-3.4	• low constraint existing air quality; low constraint existing short-term air quality; high estimated effect on air quality - incinerator stack emissions; high estimated effect on air quality - fugitive emissions

TABLE C.2

Summary of Factor Suitability Levels

Siting Option - LF-4N/PI-13N

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
COMMUNITY AND REGIONAL	B. ENVIRONMENTAL IMPACTS - (Cont'd)			
	• Community and Regional	• municipal finance	+0.1	• impact of payment-in-lieu of taxes made by OWMC is much less because of unusual municipal tax levy situation; option requires two sites, greater reduced property taxes due to negative property value impacts; slightly lower operating costs than LF-4N/PI-1N due to higher regional maintenance costs on affected access roads
		• social stability	-3.4	• second least impacted; lowest existing level of social stability; a moderate level of potential disruption through resident displacement; second most potentially disrupted through voluntary out-migration (IER, 1985a)
		• social cohesion	-3.4	• fourth most impacted; most impacted for resident displacement and third most impacted in terms of resident out-migration (IER, 1985a)
		• community character	-5.0	• potentially most impacted; most impacted with respect to heritage feature; most impacted with respect to visual compatibility; second most impacted in terms of compatibility with land use (IER, 1985a)
		• community and regional economic base	+2.6	• number of new jobs created and households generated are moderate; perception among community businesses primarily negative on possible effects of the facilities (Clayton, 1985a)
		• tourism economy	-0.5	• some impact on tourism economy (Appendix E, Volume II)
		• tourism operations	-0.5	• some impact on tourism operations (Appendix E, Volume II)

TABLE C.2

Summary of Factor Suitability Levels

Siting Option - LF-4N/PI-13N

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
COMMUNITY AND REGIONAL	B. **ENVIRONMENTAL IMPACTS** - (Cont'd)			
	• **Land Use**	• existing land use	-5.0	• has primarily agricultural land use patterns with some significant residential areas in the region, but no compatible industrial lands (LKA, 1985)
		• proposed and planned land use	-5.0	• has predominantly agricultural land use designation with some residential clusters; no industrial lands; official plan policies protect agricultural lands and may permit significant urban residential development in Milton area and infilling of rural residential clusters (LKA, 1985)
		• provincial policies and plans	-3.8	• has Parkway Belt West Plan lands providing for public and open space uses including transportation uses near PI-13N and Niagara Escarpment Plan lands near LF-4N providing for escarpment protection, complementary uses and minor settlement areas (moderately high constraint) (LKA, 1985)
	• **Agricultural Resources**	• stability of farm population	-4.0	• moderate proportion of farmers under age of 55; a moderately high proportion of full-time operators (Ecologistics, 1985)
		• stability of agricultural land base	-3.7	• high amount of land in large parcels; a moderately low amount of area owned; proportion of farm residences are moderately low; Class 1 equivalent rating is high, amount of land in private ownership is the lowest of all siting options (Ecologistics, 1985)
		• disruption to the farm economy	-5.0	• gross farm revenue in the region is high; fugitive emissions indices for crops and stack indices for livestock are high; fugitive emissions indices for livestock and stack emissions for crops are moderate (Ecologistics, 1985)

TABLE C.2

Summary of Factor Suitability Levels

Siting Option - LF-4N/PI-13N

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
ACCESS ROADS	B. **ENVIRONMENTAL IMPACTS** - (Cont'd)			
	• **Residents**	• disruption of day-to-day activities and/or the use and enjoyment of property (adjacent)	-1.9	• third most impacted; third highest number of adjacent residents; fourth highest number of age sensitive residents adjacent (IER, 1985a)
		• disruption of day-to-day activities and/or the use and enjoyment of property (vicinity)	-1.3	• third most impacted option; third highest number of residents within the noise impact zone; third highest number of residents in the vicinity (IER, 1985a)
	• **Community and Recreation Features**	• disruption of operations of community and recreation features (adjacent)	-4.1	• second most impacted; second highest number of features adjacent; second highest number of sensitive features (IER, 1985a)
		• disruption of operations of community and recreation features (vicinity)	-5.0	• greatest potential for disruption; has the largest number of features and the largest number of sensitive features in the vicinity; the number of sensitive features and total features within the noise impact zone are ranked first and second respectively, relative to the other siting options (IER, 1985a)
	• **Land Use**	• existing land use	-3.3	• moderate number of residences and commercial facilities; high proportion of residential land use along access roads (LKA, 1985)
		• planned and proposed land uses	-4.9	• route travels through rural/agricultural area with substantial amounts of residentially designated land; policies protect agricultural land; high proportion of unapproved development proposals, but fewer vacant lots of record than West Lincoln siting options (LKA, 1985)
	• **Agricultural Resources**	• disruption to the farm traffic and cattle crossings	-4.3	• vehicle impact index and number of customer/service vehicle stops are high on local roads and moderate on regional roads; cattle crossings on local roads (Ecologistics, 1985)

TABLE C.2

Summary of Factor Suitability Levels

Siting Option - LF-4N/PI-13N

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
ACCESS ROADS	B. **ENVIRONMENTAL IMPACTS** - Cont'd			
	• **Agricultural Resources**	• disruption to crop and livestock production	-1.7	• high amount of land is crops; adjacent and downstream livestock are moderate and moderately low, respectively (Ecologistics, 1985)
	• **Natural Environment**	• fish communities	-5.0	• high level for regionally significant fisheries (GLAL, 1985a)

TABLE C.3

Summary of Factor Suitability Levels

Siting Option - LF-3C

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
	A. **RISK**			
	• **Transportation**	• province-wide hazard-based spill index of OWMC generated transport	-3.3	• moderate annual non-accident related spills and annual accident related spills relative to the other siting options
		• province-wide accident involvements of OWMC generated transport	-3.2	• moderate annual accident involvement relative to the other siting options
		• transportation risks on local and regional access roads due to accident involvements of OWMC generated transport	-5.0	• high risk to road users relative to the other siting options
		• transportation risks on local and regional access roads due to hazard-based spills of OWMC generated transport	-5.0	• high risk to population, road users, sensitive uses and sensitive hydrogeologic lands and high surface water suitability relative to the other siting options
	• **Air Quality**	• risk from direct inhalation of emissions - chronic	-1.1	• low population exposure - incinerator stack emissions; low population exposure - fugitive emissions; low future population exposure - incinerator stack emissions; low future population exposure - fugitive emissions
		• risk from direct inhalation of emissions - acute	-2.6	• low level of topographic features on or around site; low population exposure - upset emissions from incinerator stack; low population exposure - upset emissions from low elevation sources; low future population exposure - upset emissions from incinerator stack; low future population exposure - upset emissions from low elevation sources; low distribution of community facilities
		• risks from ingestion of cistern and pond water	-2.3	• high exposure from cistern and pond water - incinerator stack emissions; low exposure from cistern and pond water - fugitive emissions

TABLE C.3

Summary of Factor Suitability Levels

Siting Option - LF-3C

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
	A. RISK - (Cont'd)			
	• Air Quality	• risks from consumption of crops and livestock	-5.0	• high sensitive crop exposure - incinerator stack emissions; low sensitive crop exposure - fugitive emissions; high sensitive livestock exposures - incinerator stack emissions; low sensitive livestock exposures - fugitive emissions; high future sensitive crop exposures - incinerator stack emissions; low future sensitive crop exposures - fugitive emissions; high future sensitive livestock exposures - incinerator stack emissions; low future sensitive livestock exposures - fugitive emissions
	• Hydrogeologic Suitability	• capability of providing natural containment	-1.0	• confining layer is uniform and vertically and laterally continuous; breakthrough time for both the landfill and the central operating area is anticipated to be long as a consequence of the thick confining layer (GLAL, 1985b)
		• ground water use	-1.0	• ground water supplies may be developed to the north in the Guelph Formation aquifer; aquifer use is limited primarily to domestic and agricultural requirements (GLAL, 1985b)
	• Surface Water Suitability	• susceptibility of site to flooding	-5.0	• highest constraint due to large upstream drainage area and backwater from Welland River which are not easily mitigated; some reliance on engineering may be necessary (GLAL, 1985c)
		• potential for water use interference	-2.5	• no potable uses immediately downstream from the site and high downstream surface water use index; middle level of suitability (GLAL, 1985c)

TABLE C.3

Summary of Factor Suitability Levels

Siting Option - LF-3C

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
SITE	B. **ENVIRONMENTAL IMPACTS**			
	• **Residents**	• displacement of residents	-2.6	• second least potentially impacted in terms of number of residents on-site and the overall impact of displacement of residents (IER, 1985a)
	• **Businesses**	• displacement of businesses	0.0	• no businesses displaced (Clayton, 1985a)
	• **Community and Recreation Features**	• displacement of historical, community and recreation features	0.0	• no features on-site (IER, 1985a)
		• archaeological resources[1]	-	
	• **Land Use**	• existing land use	-1.5	• few residences, no commercial or industrial facilities (LKA, 1985)
		• proposed and planned land uses	-5.0	• has generally agricultural land use designation (high constraint) with protective policies and few vacant lots of record (LKA, 1985)
		• land use stability	-5.0	• lowest proportion of lands under absentee ownership (high constraint); no land sales; high percentage of buildings in good condition, indicating the highest level of stability of all options (LKA, 1985)

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[1] Factor suitability levels not developed for archaeological resources

TABLE C.3

Summary of Factor Suitability Levels

Siting Option - LF-3C

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
SITE	B. **ENVIRONMENTAL IMPACTS** - (Cont'd)			
	• **Agricultural Resources**	• displacement of farms with on-site headquarters	-4.9	• two owned farms with headquarters on-site, both are owner-operated; estimated gross farm revenue is high (Ecologistics, 1985)
		• loss of farmland	-3.8	• one of two sites with tile drainage on-site; moderately low Class 1 equivalent rating (Ecologistics, 1985)
	• **Natural Environment**	• rare species	-1.0	• low potential impact on both rare plant and rare animal species (GLAL, 1985a)
		• natural vegetation displaced	-3.0	• 78 ha displaced (GLAL, 1985)
		• potential for occurrence of other significant features	-3.0	• moderate to high probability of finding more rare species, rare species in site vicinity and habitat is varied on-site (GLAL, 1985a)

TABLE C.3

Summary of Factor Suitability Levels

Siting Option - LF-3C

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
SITE VICINITY	B. **ENVIRONMENTAL IMPACTS** - (Cont'd)			
	• **Residents**	• property value impacts	-1.2	• a low level ($451,000) of negative property value impacts within site vicinity (Clayton, 1985a)
		• disruption of day-to-day activities and/or the use and enjoyment of property (adjacent to site)	-3.4	• third most impacted in terms of the potential for disruption of day-to-day activities of adjacent residents (IER, 1985a)
		• disruption of day-to-day activities and/or the use and enjoyment of property (non-adjacent)	-2.8	• second least impacted; has fewer residents within the noise impact zones, third lowest in terms of visual intrusion; third highest number of residents within the site vicinity (includes the students at the Robert Land Academy) (IER, 1985a)
	• **Businesses**	• business activities negatively affected by the presence of OWMC facilities	-3.1	• the number of businesses negatively affected are moderate; annual sales ($2,348,000) and number of employees negatively affected are moderately high (Clayton, 1985a)
		• business activities positively affected by the presence of OWMC facilities	0.0	• no businesses, annual sales or employees positively affected (Clayton, 1985a)
	• **Community and Recreation Features**	• disruption of operations of community and recreation features (adjacent to site)	0.0	• no features adjacent
		• disruption of operations of community and recreation features (site vicinity)	-5.0	• greatest potential impact on community and recreation features through disruption of operation; two features in the noise impact zone, both sensitive to noise; second lowest number of features and sensitive features in the site vicinity (IER, 1985a)

TABLE C.3

Summary of Factor Suitability Levels

Siting Option - LF-3C

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
SITE VICINITY	B. ENVIRONMENTAL IMPACTS - (Cont'd)			
	• Land Use	• existing land use	-2.1	• moderately low number of residences within the site vicinity, particularly within the highest impact zone; few commercial uses, no industrial lands (LKA, 1985)
		• proposed and planned land use	-4.5	• generally agricultural land use designation with no industrial designations; official plan policies are generally protective of agricultural lands (LKA, 1985)
		• land use stability	-5.0	• low proportion of land under absentee ownership (high constraint); few land sales; steadily rising land values (high constraint); moderate percentage of buildings in good condition indicating an overall level of high constraint (LKA, 1985)
		• provincial policies and plans	0.0	• not applicable to LF-3C
	• Agricultural Resources	• partial displacement of farms (off-site farms with on-site land)	-5.0	• number of farms with headquarters and their average parcel size are a moderate amount; proportion of owned land base lost is moderate, but proportion of rented land base lost is high (Ecologistics, 1985)
		• disruption of adjacent farm operations	-3.7	• moderately high number of farms with headquarters, high amount of owner-operated land; livestock density is moderately low (Ecologistics, 1985)
		• disruption of non-adjacent farm operations	-4.6	• moderately high number of farms with headquarters; high livestock density; proportion of land in crops is moderately high (Ecologistics, 1985)

TABLE C.3

Summary of Factor Suitability Levels

Siting Option - LF-3C

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
SITE VICINITY	B. ENVIRONMENTAL IMPACTS - (Cont'd)			
	• Natural Environment	• significant environmental units (SEUs)	-1.0	• approximately 100 ha (GLAL, 1985a)
		• fish and wildlife features of significance	-5.0	• 4 features (GLAL, 1985a)
		• other natural vegetation	-3.0	• approximately 298 ha (GLAL, 1985a)
		• rare species	-5.0	• high potential impact on rare plant species (GLAL, 1985a)
	• Air Dispersion/ Air Quality	• restraints to dispersion	-1.0	• no significant modification (ORF, 1985)
		• existing and anticipated air quality	-2.8	• low constraint existing air quality; low constraint existing short-term air quality; high estimated effect on air quality - incinerator stack emission; high estimated effect on air quality - fugitive emissions

TABLE C.3

Summary of Factor Suitability Levels

Siting Option - LF-3C

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
COMMUNITY AND REGIONAL	B. ENVIRONMENTAL IMPACTS - (Cont'd)			
	• Community and Regional	• municipal finance	+4.9	• impact of payments-in-lieu of taxes made by OWMC is large compared to municipal tax base, financial impacts on operating costs of the area municipality are less because of lower levels of service, negative property value impacts are lower because of fewer affected households and lower taxes
		• social stability	-4.5	• potentially third most impacted; second least disruption through displacement of residents; potentially most impacted through voluntary out-migration of residents (IER, 1985a)
		• social cohesion	-5.0	• potentially most impacted; highest potential disruption through resident out-migration; moderate level of disruption due to resident displacement (IER, 1985a)
		• community character	-4.5	• fourth most potentially impacted; most rural of siting options potentially most impacted in terms of land use compatibility; fourth most impacted in terms of heritage features and visual compatibility (IER, 1985a)
		• community and regional econocic base	+2.0	• number of new jobs created and households generated are moderately low; perceptions among community businesses are primarily negative on the possible effects of the facilities (Clayton, 1985a)
		• tourism economy	0.0	• no tourism economy impact (Appendix E, Volume II)
		• tourism operations	0.0	• no tourism operations impact (Appendix E, Volume II)

TABLE C.3

Summary of Factor Suitability Levels

Siting Option - LF-3C

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
COMMUNITY AND REGIONAL	5. ENVIRONMENTAL IMPACTS - (Cont'd)			
	• Land Use	• existing land use	-3.3	• has limited residential lands; no industrial land use (LKA, 1985)
		• proposed and planned land use	-3.8	• predominantly agricultural land use designations with minor residential clusters; no industrial lands; official plan policies protect agricultural lands, but may permit facilities if impacts minimized (LKA, 1985)
		• provincial policies and plans	0.0	• plans not applicable to LF-3C
	• Agricultural Resources	• stability of farm population	-4.6	• high proportion of operators are under age 55; a moderately high number of operators are full-time (Ecologistics, 1985)
		• stability of agricultural land base	-4.4	• high amount of owner-operated land, large parcels, farmed land; moderate proportion of total number of residences are farm residences; Class 1 equivalent rating is moderately high; amount of private land ownership is high (Ecologistics, 1985)
		• disruption to the farm economy	-4.5	• gross farm revenue is moderately low; relative exposure of crops and livestock to fugitive and stack emissions is moderately low; amount of downstream livestock is high (Ecologistics, 1985)

TABLE C.3

Summary of Factor Suitability Levels

Siting Option - LF-3C

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
ACCESS ROADS	B. **ENVIRONMENTAL IMPACTS** - (Cont'd)			
	• **Residents**	• disruption of day-to-day activities and/or the use and enjoyment of property (adjacent)	-5.0	• greatest potential impact on residents living adjacent; highest number of residents adjacent; highest number of sensitive residents (IER, 1985a)
		• disruption of day-to-day activities and/or the use and enjoyment of property (vicinity)	-5.0	• highest potential impact in the vicinity; highest number of residents in the vicinity; highest number of residents within the noise impact zone (IER, 1985a)
	• **Community and Recreation Features**	• disruption of operations of community and recreation features (adjacent)	-5.0	• greatest potential impact on community and recreation features adjacent; highest number of features adjacent; highest number of sensitive features (IER, 1985a)
		• disruption of operations of community and recreation features (vicinity)	-4.6	• second most impacted; second highest number of features; highest number of sensitive features; highest number of features in the noise impact zone; second highest number of sensitive features in the noise impact zone (IER, 1985a)
	• **Land Use**	• existing land uses	-5.0	• high number of residences and commercial facilities; high proportion of residential lands (LKA, 1985)
		• planned and proposed land uses	-5.0	• route travels through rural/agricultural areas with substantial amounts of residentially designated lands; policies protect agricultural lands, high number of vacant lots of record (LKA, 1985)
	• **Agricultural Resources**	• disruption to the farm traffic and cattle crossings	-5.0	• moderately high vehicle impact index rating; high number of cattle crossings along local roads (Ecologistics, 1985)

TABLE C.3

Summary of Factor Suitability Levels

Siting Option - LF-3C

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
ACCESS ROADS	B. ENVIRONMENTAL IMPACTS - (Cont'd)			
	• Agricultural Resources	• disruption to crop and livestock production	-5.0	• amount of adjacent crops, livestock and downstream livestock all rate high (Ecologistics, 1985)
	• Natural Environment	• fish communities	-3.0	• medium constraint for regionally significant fisheries in combination with a high constraint for locally significant fisheries (GLAL, 1985a)

TABLE C.4

Summary of Factor Suitability Levels

Siting Option - LF-9C

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
	A. **RISK**			
	• **Transportation**	• province-wide hazard-based spill index of OWMC generated transport	-3.3	• moderate annual accident-related spills and non-accident related spills relative to other siting options
		• province-wide accident involvements of OWMC generated transport	-3.2	• moderate annual accident involvement relative to the other siting options
		• transportation risks on local and regional access roads due to accident involvements of OWMC generated transport	-4.6	• high risk to road users relative to the other siting options
		• transportation risks on local and regional access roads due to hazard-based spills of OWMC generated transport	-3.9	• moderately high risk to population; high risk to road users and sensitive hydrogeologic lands; moderate risk to sensitive uses and moderately high surface water suitability relative to the other siting options
	• **Air Quality**	• risk from direct inhalation of emissions - chronic	-1.5	• low population exposure - incinerator stack emissions; low population exposure - fugitive emissions; low future population exposure - incinerator stack emissions; low future population exposure - fugitive emissions
		• risk from direct inhalation of emissions - acute	-2.9	• few topographic features on or around the site; low population exposure - upset emissions from incinerator stack; low population exposure - upset emissions from low elevation sources; low future population exposure - upset emissions from incinerator stack; low future population exposure - upset emissions from low elevation sources; low distribution of community facilities
		• risks from ingestion of cistern and pond water	-1.5	• low exposure from cistern and pond water - incinerator stack emissions; low exposure from cistern and pond water - fugitive emissions

TABLE C.4

Summary of Factor Suitability Levels

Siting Option - LF-9C

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
	A. **RISK** - (Cont'd)			
	• **Air Quality**	• risks from consumption of crops and livestock	-5.0	• high sensitive crop exposures - incinerator stack emissions; low sensitive crop exposures - fugitive emissions; high sensitive livestock exposures - incinerator stack emissions; high sensitive livestock exposures - fugitive emissions; high future sensitive crop exposures - incinerator stack emissions; high future sensitive crop exposures - fugitive emissions; high future sensitive livestock exposure - incinerator stack emissions; high future sensitive livestock exposure - fugitive emissions
	• **Hydrogeologic Suitability**	• capability of providing natural containment	-1.0	• confining layer is uniform and vertically and laterally continuous; breakthrough time for both landfill and the central operating area is anticipated to be long as a consequence of the thick confining layer (GLAL, 1985b)
		• ground water use	-5.0	• ground water supplies may be developed in the Guelph Formation aquifer sufficiently removed from the site to be unaffected; aquifer may be capable of meeting more demanding water use requirements (GLAL, 1985b)
	• **Surface Water Suitability**	• susceptibility of site to flooding	-2.3	• flooding not considered to be a concern; lowest level of relative constraint (GLAL, 1985c)
		• potential for water use interference	-2.5	• middle level of relative suitability; no potable use immediately downstream from the site and high downstream surface water use index (GLAL, 1985c)

TABLE C.4

Summary of Factor Suitability Levels

Siting Option - LF-9C

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
SITE	B. ENVIRONMENTAL IMPACTS			
	• Residents	• displacement of residents	-1.3	• potentially least impacted; least number of residents on-site; least impacted in terms of both characteristics and attachment to place (IER, 1985a)
	• Businesses	• displacement of businesses	0.0	• no businesses displaced (Clayton, 1985a)
	• Community and Recreation Features	• displacement of historical, community and recreation features	0.0	• no features on-site (IER, 1985a)
		• archaeological resources[1]	-	-
	• Land Use	• existing land use	-0.7	• fewest residences, no commercial or industrial facilities/uses on-site (LKA, 1985)
		• proposed and planned land uses	-5.0	• has generally agricultural land use designations (high constraint) with protective policies and few vacant lots of record (LKA, 1985)
		• land use stability	-3.6	• moderate proportion of lands under absentee ownership (high constraint); no land sales and all buildings in good condition, indicating a moderate level of stability (LKA, 1985)

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[1] Factor suitability levels not developed for archaeological resources.

TABLE C.4

Summary of Factor Suitability Levels

Siting Option - LF-9C

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
SITE	B. **ENVIRONMENTAL IMPACTS** - (Cont'd)			
	• **Agricultural Resources**	• displacement of farms with on-site headquarters	-2.6	• two operations with headquarters on-site, both are owner-operated; farm size and estimated gross farm revenue are moderate relative to other siting options (Ecologistics, 1985)
		• loss of farmland	-2.3	• Class 1 equivalent rating is low; one of two sites with tile drainage on-site (Ecologistics, 1985)
	• **Natural Environment**	• rare species	-5.0	• high potential impact on both rare plant and rare animal species (GLAL, 1985a)
		• natural vegetation displaced	-1.0	• 23 ha displaced (GLAL, 1985a)
		• potential for occurrence of other significant features	-1.0	• site well studied already, probability of finding additional significant occurrences is low (GLAL, 1985a)

TABLE C.4

Summary of Factor Suitability Levels

Siting Option - LF-9C

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
SITE VICINITY	B. **ENVIRONMENTAL IMPACTS** - (Cont'd)			
	• **Residents**	• property value impacts	-1.2	• low level ($435,000) of negative property impacts in the site vicinity (Clayton, 1985a)
		• disruption of day-to-day activities and/or the use and enjoyment of property (adjacent to site)	-2.4	• fewer residents adjacent and fewer residents at home during the day on properties adjacent, than LF-3C (IER, 1985a)
		• disruption of day-to-day activities and/or use and enjoyment of property (non-adjacent)	-4.8	• third most impacted; considerably more residents spending most of their time on their properties within the 55dBA noise impact zone; largest number of total residents within the 55dBA zone; moderately impacted with respect to visual impact; least residents within the 2 km study area (IER, 1985a)
	• **Businesses**	• business activities negatively affected by the presence of OWMC facilities	-0.7	• few businesses negatively affected; annual sales ($355,000) and number of employees negatively affected are low (Clayton, 1985a)
		• business activities positively affected by the presence of OWMC facilities	+0.1	• few businesses and employees positively affected; annual sales are low (Clayton, 1985a)
	• **Community and Recreation Features**	• disruption of operations of community and recreation features (adjacent to site)	0.0	• no features adjacent (IER, 1985a)
		• disruption of operations of community and recreation features (site vicinity)	-0.3	• least impacted; fewest features and sensitive features; no features within the noise impact zone (IER, 1985a)

TABLE C.4

Summary of Factor Suitability Levels

Siting Option - LF-9C

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
SITE VICINITY	B. **ENVIRONMENTAL IMPACTS** - (Cont'd)			
	• **Land Use**	• existing land use	-2.0	• moderately low number of residences within the site vicinity, particularly within the highest impact zone; few commercial uses, no industrial lands; fewest residences overall, though slightly more than LF-3C in the 1,000 m zone (LKA, 1985)
		• proposed and planned land use	-4.4	• generally agricultural land use designations; no industrial designations; official plan policies are generally protective of agricultural lands (LKA, 1985)
		• land use stability	-5.0	• low proportion of land under absentee ownership (high constraint); few land sales, steadily raising land values (high constraint), moderate percentage of buildings in good condition, indicating an overall level of high stability (LKA, 1985)
		• provincial policies and plans	0.0	• not applicable to LF-9C
	• **Agricultural Resources**	• partial displacement of farms (off-site farms with on-site land)	-2.3	• number and size of partially displaced farms is small; the proportion of owned land base lost is of moderate consequence; no rented land lost (Ecologistics, 1985)
		• disruption of adjacent farm operations	-4.6	• number of farm with headquarters and livestock density are both rated high; moderately high number of operators with owned land (Ecologistics, 1985)
		• disruption of non-adjacent farm operations	-5.0	• livestock densities are very high; number of farms with headquarters is moderately high; proportion of non-adjacent vicinity in crops is high (Ecologistics, 1985)

TABLE C.4

Summary of Factor Suitability Levels

Siting Option - LF-9C

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
SITE VICINITY	B. ENVIRONMENTAL IMPACTS - (Cont'd)			
	• Natural Environment	• significant environmental units (SEUs)	-1.0	• approximately 145ha (GLAL, 1985a)
		• fish and wildlife features of significance	-3.0	• 2 features (GLAL, 1985a)
		• other natural vegetation	-1.0	• approximately 111 ha, lowest of all siting options (GLAL, 1985a)
		• rare species	-1.0	• low potential impact on rare plant species; moderate potential impact on rare animal species (GLAL, 1985a)
	• Air Dispersion/ Air Quality	• restraints to dispersion	-1.0	• no significant restraints (ORF, 1985)
		• existing and anticipated air quality	-2.9	• low constraint existing air quality; low constraint existing short-term air quality; high estimated effect on air quality - incinerator stack emissions; high estimated effect on air quality - fugitive emissions

TABLE C.4

Summary of Factor Suitability Levels

Siting Option - LF-9C

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
COMMUNITY A ND REGIONAL	B. **ENVIRONMENTAL IMPACTS** - (Cont'd)			
	• **Community and Regional**	• municipal finance	+5.0	• impact of payments-in-lieu of taxes made by OWMC is large compared to the tax base; financial impacts on operating costs of the area municipality are less because of lower levels of service, (slightly lower increase than LF-3C due to lower regional maintenance costs on affected access roads); negative property value impacts are lower because of fewer affected households and lower taxes
		• social stability	-4.2	• most stable; fourth most potentially impacted; overall potential for disruption through voluntary out-migration and resident displacement is considered moderate (IER, 1985a)
		• social cohesion	-1.0	• potentially least impacted; lowest disruption to the cohesion through resident displacement and voluntary out-migration (IER, 1985a)
		• community character	-4.6	• third most impacted; most rural of all options; potentially most impacted in terms of land use compatibility; third most impacted in terms of heritage features and visual compatibility (IER, 1985a)
		• community and regional economic base	+2.4	• number of new jobs created are low; number of additional households generated are moderately low; perceptions among community business are primarily negative on the possible effects of the facilities (Clayton, 1985a)
		• tourism economy	0.0	• no tourism economy impact (Appendix E, Vol. II)
		• tourism operations	0.0	• no tourism operations impact (Appendix E, Vol. II)

TABLE C.4

Summary of Factor Suitability Levels

Siting Option - LF-9C

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
COMMUNITY AND REGIONAL	B. ENVIRONMENTAL IMPACTS - (Cont'd)			
	• Land Use	• existing land use	-3.3	• has limited residential lands; no industrial land use (LKA, 1985)
		• proposed and planned land use	-3.8	• predominantly agricultural land use designations with minor residential clusters; no industrial lands; official plan policies protect agricultural lands, but may permit facilities if impacts minimized (LKA, 1985)
		• provincial policies and plans	0.0	• not applicable to LF-9C
	• Agricultural Resources	• stability of farm population	-5.0	• percent of operators under 55 years of age is high; proportion of full-time operators is moderately high (Ecologistics, 1985)
		• stability of agricultural land base	-5.0	• most of the land is owner-operated; farmed and in large parcels; farm residents dominate the total number of residents and a moderate amount of land is of Class 1 equivalent (Ecologistics, 1985)
		• disruption to the farm economy	-4.9	• gross farm revenue is moderate; relative exposure of livestock to fugitive emissions is high, whereas for crops it is moderately low; relative exposure of livestock to stack emissions is moderately low, but for crops is moderately high; a moderately high amount of downstream livestock (Ecologistics, 1985)

TABLE C.4

Summary of Factor Suitability Levels

Siting Option - LF-9C

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
ACCESS ROADS	B. **ENVIRONMENTAL IMPACTS** - (Cont'd)			
	• **Residents**	• disruption of day-to-day activities and/or the use and enjoyment of property (adjacent)	-3.9	• second highest potential impact; second highest number of adjacent residents; second highest number of sensitive residents (IER, 1985a)
		• disruption of day-to-day activities and/or the use and enjoyment of property (vicinity)	-4.5	• second highest potentially impacted; second highest number of residents in the access road vicinity; second highest number of residents within the noise impact zone (IER, 1985a)
	• **Community and Recreation Features**	• disruption of operations of community and recreation features (adjacent)	-3.5	• second lowest number of community and recreation features and sensitive features adjacent to the access road (IER, 1985a)
		• disruption of operations of community and recreation features (vicinity)	-3.4	• second potentially least impacted; second lowest number of features in the vicinity; second highest number of sensitive features in the vicinity; third highest number of features and sensitive features in the noise impact zone (IER, 1985a)
	• **Land Use**	• existing land uses	-5.0	• high number or residences and commercial facilities; high proportion of residential lands (LKA, 1985)
		• planned and proposed land uses	-5.0	• route travels through rural/agricultural areas with substantial amounts of residentially designated lands; policies protect agricultural lands, high number of vacant lots of record (LKA, 1985)
	• **Agricultural Resources**	• disruption to the farm traffic and cattle crossings	-1.5	• local road impacts are negligible, but along regional roads the agricultural vehicle impact index is moderate and the number of customer/service vehicle stops is moderately low (Ecologistics, 1985)

TABLE C.4

Summary of Factor Suitability Levels

Siting Option - LF-9C

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
ACCESS ROADS	B. **ENVIRONMENTAL IMPACTS** - (Cont'd)			
	• **Agricultural Resources**	• disruption to crop and livestock production	-2.6	• adjacent crops and downstream livestock rate moderately high; adjacent livestock rates moderate; moderate livestock population (Ecologistics, 1985)
	• **Natural Environment**	• fish communities	-3.0	• medium constraint for regionally significant fisheries and low constraint for locally significant fisheries (GLAL, 1985a)

TABLE C.5

Summary of Factor Suitability Levels

Siting Option - LF-1E

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
	A. **RISK**			
	• **Transportation**	• province-wide hazard-based spill index of OWMC generated transport	-5.0	• high annual accident-related spills and annual non-accident related spills relative to the other siting options
		• province-wide accident involvements of OWMC generated transport	-5.0	• high annual accident involvement relative to other siting options
		• transportation risks on local and regional access roads due to accident involvements of OWMC generated transport	-0.2	• low risk to road users relative to the other siting options
		• transportation risks on local and regional access roads due to hazard-based spills of OWMC generated transport	-0.2	• low risk to population, road users, sensitive uses and sensitive hydrogeologic lands and low surface water suitability relative to the other siting options
	• **Air Quality**	• risk from direct inhalation of emissions - chronic	-2.7	• high population exposure - incinerator stack emissions; low population exposure - fugitive emissions; low relative future population exposure - incinerator stack emissions; low future population exposure- fugitive emissions
		• risk from direct inhalation of emissions - acute	-3.8	• low topographic features on or around site; low population exposure - upset emissions from incinerator stack; high population exposure - upset emissions from low elevation sources; low future population exposure - upset emissions from incinerator stack; high future population exposure - upset emissions from low elevation sources; low distribution of community facilities
		• risks from ingestion of cistern and pond water	-5.0	• high exposure from cistern and pond water - incinerator stack emissions; high exposure from cistern and pond water - fugitive emissions

TABLE C.5

Summary of Factor Suitability Levels

Siting Option - LF-1E

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
	A. RISK - (Cont'd)			
	• Air Quality	• risks from consumption of crops and livestock	-1.7	• low sensitive crop exposure - incinerator stack emissions; low sensitive crop exposures - fugitive emissions; low sensitive livestock exposures - incinerator emissions; low sensitive livestock exposures - fugitive emissions; low future sensitive crop exposures - incinerator stack emissions; low future sensitive crop exposures - fugitive emissions; low future sensitive livestock exposures - incinerator stack emissions; low future sensitive livestock exposures - fugitive emissions
	• Hydrogeologic Suitability	• capability of providing natural containment	-4.0	• confining layer thins to extinction under south-eastern portion of site as a result of a local morainal feature; sand layers associated with the moraine could be present within the confining layer under the site; breakthrough time will vary locally as a result of local variability in confining layer thickness (GLAL, 1985b)
		• ground water use	-5.0	• ground water supplies may be developed in either the Guelph Formation or shallow granular aquifers sufficiently removed from the site to be unaffected; aquifer may be capable of meeting more stringent water use requirements (GLAL, 1985b)
	• Surface Water Suitability	• susceptibility of site to flooding	-2.3	• flooding not considered to be a concern; lowest level of relative constraint (GLAL, 1985c)
		• potential for water use interference	-0.8	• lowest level of suitability due to no potable uses immediately downstream from the site and low downstream surface water use index (GLAL, 1985c)

TABLE C.5

Summary of Factor Suitability Levels

Siting Option - LF-1E

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
SITE	B. **ENVIRONMENTAL IMPACTS**			
	• **Residents**	• displacement of residents	-4.0	• second most impacted; greatest number of residents displaced; second most impacted due to their characteristics; most impacted for attachment to place (IER, 1985a)
	• **Businesses**	• displacement of businesses	-3.6	• a moderately high number of businesses displaced; estimated annual sales ($1,741,000) are moderately high (Clayton, 1985a)
	• **Community and Recreation Features**	• displacement of historical, community and recreation features	0.0	• no on-site features (IER, 1985a)
		• archaeological resources[1]	-	
	• **Land Use**	• existing land use	-4.7	• has a high number of residences and some commercial/industrial facilities/uses on-site; less displacement of existing uses than LF-1E/PI-27E (LKA, 1985)
		• proposed and planned land uses	-4.7	• has generally agricultural land use designations (high constraint) with protective policies and few vacant lots of record; may permit public treatment facilities without amendment to the Official Plan (LKA, 1985)
		• land use stability	-4.1	• has a moderately low proportion of lands under absentee ownership (moderately high constraint); no land sales; only a moderate percentage of buildings in good condition indicating a moderately high level of stability overall (LKA, 1985)

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[1] No factor suitability levels developed for archaeological resources.

TABLE C.5

Summary of Factor Suitability Levels

Siting Option - LF-1E

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
SITE	B. **ENVIRONMENTAL IMPACTS** - (Cont'd)			
	• **Agricultural Resources**	• displacement of farms with on-site headquarters	-3.9	• many operations with headquarters, all of which are owner-operated, but with a relative small average size, estimated gross farm revenue is moderately low (Ecologistics, 1985)
		• loss of farmland	-3.4	• no tile drained land on-site; Class 1 land equivalent rating is moderate (Ecologistics, 1985)
	• **Natural Environment**	• rare species	-1.0	• low potential impact on both rare plant and rare animal species (GLAL, 1985a)
		• natural vegetation displaced	-5.0	• c. 92 ha displaced (GLAL, 1985a)
		• potential for occurrence of other significant features	-5.0	• considerable area of natural vegetation on-site; high probability of finding more rare species in Niagara (GLAL, 1985a)

TABLE C.5

Summary of Factor Suitability Levels

Siting Option - LF-1E

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
SITE VICINITY	B. **ENVIRONMENTAL IMPACTS** - (Cont'd)			
	• **Residents**	• property value impacts	-1.8	• moderately low ($679,000) degree of negative property impacts within the site vicinity (Clayton, 1985a)
		• disruption of day-to-day activities and/or the use and enjoyment of property (adjacent to site)	-1.3	• least impacted; fewest number of residents adjacent; fewest number of residents at home during the day on adjacent properties (IER, 1985a)
		• disruption of day-to-day activities and/or the use and enjoyment of property (non-adjacent)	-2.7	• least impacted; least impacted in terms of visual intrusion; second least impacted in terms of noise; relatively high number of residents live in the vicinity (IER, 1985a)
	• **Businesses**	• business activities negatively affected by the presence of OWMC facilities	-1.5	• number of businesses negatively affected are low; number of employees and annual sales ($1,333,000) are moderately low (Clayton, 1985a)
		• business activities positively affected by the presence of OWMC facilities	+0.1	• few businesses and employees positively affected; annual sales are low (Clayton, 1985a)
	• **Community and Recreation Features**	• disruption of operations of community and recreation features (adjacent to site)	0.0	• no features adjacent (IER, 1985a)
		• disruption of operations of community and recreation features (site vicinity)	-1.7	• second least impacted; no features within the noise impact zone; third highest number of features located in the site vicinity; second highest number of sensitive features in the site vicinity (IER, 1985a)

TABLE C.5

Summary of Factor Suitability Levels

Siting Option - LF-1E

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
SITE VICINITY	B. **ENVIRONMENTAL IMPACTS** - (Cont'd)			
	• **Land Use**	• existing land use	-3.6	• moderate number of residences proportion of residential land uses and residential density (LKA, 1985)
		• proposed and planned land use	-4.4	• generally agricultural land use designations; has some general industrial lands; official plan policies are generally protective of agricultural lands; industrial designations and development policies near LF-1E are partially offset by a limited amount of residentially and commercially-zoned land nearby and substantially higher number of vacant lots of record (LKA, 1985)
		• land use stability	-3.6	• moderate proportion of lands under absentee ownership; relatively few land sales (high constraint); no discernible trend in land values (moderate constraint) and a moderate percentage of buildings of good quality indicating an overall level of moderate stability (LKA, 1985)
		• provincial policies and plans	0.0	• not applicable to LF-1E
	• **Agricultural Resources**	• partial displacement of farms (off-site farms with on-site land)	-4.3	• moderately few small headquarter farms in the vicinity losing on-site land, but the proportion of the land base lost is moderately high (Ecologistics, 1985)
		• disruption of adjacent farm operations	-2.1	• number of farms with headquarters, number of operators with owned land and livestock density are moderately low (Ecologistics, 1985)
		• disruption of non-adjacent farm operations	-2.9	• number of headquarter farms is moderately high; moderate proportion of land is in crops and livestock density is low (Ecologistics, 1985)

TABLE C.5

Summary of Factor Suitability Levels

Siting Option - LF-1E

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
SITE VICINITY	B. ENVIRONMENTAL IMPACTS - (Cont'd)			
	• Natural Environment	• significant environmental units (SEUs)	-3.0	• approximately 386 ha, second largest area (GLAL, 1985a)
		• fish and wildlife features of significance	-3.0	• 2 features (GLAL, 1985a)
		• other natural vegetation	-3.0	• approximately 333 ha, second largest area (GLAL, 1985a)
		• rare species	-1.0	• low potential impact on rare plant and animal species (GLAL, 1985a)
	• Air Dispersion/ Air Quality	• restraints to dispersion	-1.0	• no significant restraints (ORF, 1985)
		• existing and anticipated air quality	-3.5	• high constraint existing air quality; low constraint existing short-term air quality; low estimated effect on air quality - incinerator stack emissions; low estimated effect on air quality - fugitive emissions

TABLE C.5

Summary of Factor Suitability Levels

Siting Option - LF-1E

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
COMMUNITY AND REGIONAL	B. ENVIRONMENTAL IMPACTS - (Cont'd)			
	• Community and Regional	• municipal finance	+2.8	• large increase in operating costs because of high levels of area municipal service; revenue increases are high due to higher tax rates and greater anticipated household growth (Clayton, 1985b)
		• social stability	-4.9	• second most impacted; third most stable siting option; second highest potential disruption through resident displacement; second least disruption by residents voluntarily leaving the area (IER, 1985a)
		• social cohesion	-4.6	• potentially third highest impacted; second most impacted in terms of resident displacement; second least impacted in terms of residents out-migration (IER, 1985a)
		• community character	-4.0	• second least impacted; second least potential impacts in terms of heritage features and land use compatibility; least impacted in terms of visual compatibility (IER, 1985a)
		• community and regional economic base	+4.5	• number of new jobs created and households generated are moderately high; perception among community businesses are balanced between positive and negative for possible effects of the facilities (Clayton, 1985a)
		• tourism economy	-5.0	• largest tourism economy impact (Appendix E, Vol. II)
		• tourism operations	0.0	• no impact on tourism operators (Appendix E, Vol. II)

TABLE C.5

Summary of Factor Suitability Levels

Siting Option - LF-1E

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
COMMUNITY AND REGIONAL	B. **ENVIRONMENTAL IMPACTS** - (Cont'd)			
	• **Land Use**	• existing land use	-1.7	• has a limited amount of residential land use but significant amounts of compatible industrial land use (LKA, 1985)
		• proposed and planned land use	-2.6	• has generally agricultural lands with substantial amounts of compatible industrial designations; industrial development somewhat offset by policies protecting agricultural uses and permitting residential infilling in Cook's Mills area (LKA, 1985)
		• provincial policies and plans	0.0	• not applicable to LF-1E
	• **Agricultural Resources**	• stability of farm population	-2.6	• moderately high percentage of operators are under the age of 55, but there are very few full-time operators (Ecologistics, 1985)
		• stability of agricultural land base	-3.4	• a moderate proportion of land is farmed, owned and in large parcels; proportion of farm residences is low; capability ratings are moderately high; high proportion of land is in private ownership (Ecologistics, 1985)
		• disruption to the farm economy	-1.5	• gross farm revenue is low as are stack emission indices for livestock; indices for fugitive emissions and downstream livestock are relatively low (Ecologistics, 1985)

TABLE C.5

Summary of Factor Suitability Levels

Siting Option - LF-1E

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
ACCESS ROADS	B. **ENVIRONMENTAL IMPACTS** - (Cont'd)			
	• **Residents**	• disruption of day-to-day activities and/or the use and enjoyment of property (adjacent)	-0.1	• second least impacted; second lowest number of residents adjacent; second lowest number of age sensitive residents adjacent (IER, 1985a)
		• disruption of day-to-day activities and/or the use and enjoyment of property (vicinity)	-0.1	• lowest number of residents in the vicinity; second lowest number of residents within the noise impact zone (IER, 1985a)
	• **Community and Recreation Features**	• disruption of operations of community and recreation features (adjacent)	-0.1	• potentially least impacted; only one feature adjacent, not considered significant (IER, 1985a)
		• disruption of operations of community and recreation features (vicinity)	-0.3	• potentially least impacted; fewest features in the vicinity, none sensitive; one feature considered noise sensitive within the noise impact zone (IER, 1985a)
	• **Land Use**	• existing land uses	-0.8	• has few residences or commercial facilities and no residential land uses (LKA, 1985)
		• planned and proposed land uses	-0.6	• has no residential designations, no constraining official plan policies, no unapproved development proposals and a low number of vacant lots of record (LKA, 1985)
	• **Agricultural Resources**	• disruption to the farm traffic and cattle crossings	0	• no customer/service vehicle stops along local or regional roads; agricultural vehicle impact index is very low along both regional and local roads (Ecologistics, 1985)

TABLE C.5

Summary of Factor Suitability Levels

Siting Option - LF-1E

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
ACCESS ROADS	**B. ENVIRONMENTAL IMPACTS** - (Cont'd)			
	• **Agricultural Resources**	• disruption to crop and livestock production	-0.1	• a very low amount of land is in crops and very little livestock; no downstream livestock affected (Ecologistics, 1985)
	• **Natural Environment**	• fish communities	-1.0	• zero length of both significant regional and local fisheries (GLAL, 1985a)

TABLE C.6

Summary of Factor Suitability Levels

Siting Option - LF-1E/PI-27/E

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
	A. **RISK**			
	• **Transportation**	• province-wide hazard-based spill index of OWMC generated transport	-5.0	• high annual accident-related spills and annual non-accident-related spills relative to the other siting options
		• province-wide accident involvements of OWMC generated transport	-5.0	• high annual accident involvement relative to the other siting options
		• transportation risks on local and regional access roads due to accident involvements of OWMC generated transport	-0.2	• low risk to road users relative to the other siting options
		• transportation risks on local and regional access roads due to hazard-based spills of OWMC generated transport	-0.2	• low risk to population, road users, sensitive uses and sensitive hydrogeologic lands and low surface water suitability relative to the other siting options
	• **Air Quality**	• risk from direct inhalation of emissions - chronic	-5.0	• high population exposure - incinerator stack emissions; high population exposure - fugitive emissions; high future population exposure - incinerator stack emissions; high future population exposure - fugitive emissions
		• risk from direct inhalation of emissions - acute	-4.1	• low level topographic features on or around the site; high population exposure - upset emissions from incinerator stack; low population exposure - upset emissions from low elevation sources; high future population exposure - upset emissions from incinerator stack; low future population exposure - upset emissions from low elevation sources; low distribution of community facilities
		• risks from ingestion of cistern and pond water	-1.0	• low exposure from cistern and pond water - incinerator stack emissions; low relative exposure from cistern and pond water - fugitive emissions

TABLE C.6

Summary of Factor Suitability Levels

Siting Option - LF-1E/PI-27/E

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
	A. RISK - (Cont'd)			
	• Air Quality	• risks from consumption of crops and livestock	-1.3	• low sensitive crop exposures - incinerator stack emissions; low sensitive crop exposures - fugitive emissions; low sensitive livestock exposures - incinerator stack emissions; low sensitive livestock exposures - fugitive emissions; low future sensitive crop exposures - incinerator stack emissions; low future sensitive crop exposures - fugitive emissions; low future sensitive livestock exposures - incinerator stack emissions; low future sensitive livestock exposures - fugitive emissions
	• Hydrogeologic Suitability	• capability of providing natural containment	-4.0	• confining layer varies under both sites as a result of locally occurring geologic features at LF-1E: local morainal feature to south-west; PI-27E: buried sand to north-west; sand layers could be present within the confining layer under portions of both sites; breakthrough times anticipated to very locally at both sites as a result of variable confining layer thicknesses (GLAL, 1985b)
		• ground water use	-5.0	• ground water supplies may be developed in the Guelph Formation aquifer or shallow granular aquifers; aquifer may be capable of meeting more stringent water use requirements
	• Surface Water Suitability	• susceptibility of site to flooding	-3.0	• second lowest relative level of constraint due to large upstream area for Grassy Brook (GLAL, 1985c)
		• potential for water use interference	-0.8	• lowest level of suitability due to no potable uses immediately downstream from the site and low downstream surface water use index (GLAL, 1985c)

TABLE C.6

Summary of Factor Suitability Levels

Siting Option - LF-1E/PI-27/E

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
SITE	B. ENVIRONMENTAL IMPACTS			
	• Residents	• displacement of residents	-5.0	• potentially most impacted; second highest number of residents on-site; potentially more impacted due to their characteristics and second most impacted due to their attachment of place (IER, 1985a)
	• Businesses	• displacement of businesses	-5.0	• largest number of businesses displaced; estimated annual sales ($2.6 million) is comparatively high (Clayton, 1985a)
	• Community and Recreation Features	• displacement of historical, community and recreation features	0.0	• no on-site features (IER, 1985a)
		• archaeological resources[1]	-	
	• Land Use	• existing land use	-5.0	• high number of residences and some commercial or industrial uses/facilities on-site; more development of existing uses than LF-1E (LKA, 1985)
		• proposed and planned land uses	-2.5	• compatible land use designations and zoning; heavy industrial designations on PI-27E compatible with physical/chemical treatment plant while agricultural designation on LF-1E is a lesser constraint to a landfill facility than to treatment facilities (LKA, 1985)
		• land use stability	-2.5	• moderate proportion of lands under absentee ownership (moderate constraint); some land sales; relatively low percentage of buildings in good condition, indicating a moderately low level of stability (moderately low constraint) (LKA, 1985)

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[1] Factor suitability levels not developed for archaeological resources.

TABLE C.6

Summary of Factor Suitability Levels

Siting Option - LF-1E/PI-27/E

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
SITE	B. ENVIRONMENTAL IMPACTS - (Cont'd)			
	• Agricultural Resources	• displacement of farms with on-site headquarters	-2.9	• many (5) operations with headquarters; all are owner-operated; very small average size; estimated gross farm revenue is low (Ecologistics, 1985)
		• loss of farmland	-1.7	• Class 1 equivalent rating is low; no tile drainage on-site (Ecologistics, 1985)
	• Natural Environment	• rare species	-5.0	• high impact on rare plant and animal species (GLAL, 1985a)
		• natural vegetation displaced	-3.0	• 67 ha displaced (GLAL, 1985a)
		• potential for occurrence of other significant features	-5.0	• high potential on two sites to find more rare species; considerable area of natural vegetation on site; high probability of finding more rare species in Niagara (GLAL, 1985a)

TABLE C.6

Summary of Factor Suitability Levels

Siting Option - LF-1E/PI-27/E

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
SITE VICINITY	B. **ENVIRONMENTAL IMPACTS** - (Cont'd)			
	• **Residents**	• property value impacts	-2.8	• moderate degree ($1,050,000) of negative property value impacts in the site vicinity (Clayton, 1985a)
		• disruption of day-to-day activities and/or the use and enjoyment of property (adjacent to site)	-2.1	• second least impacted; slightly higher number of people live adjacent to this option than LF-9C, but a lower number of residents are at home during the day on properties adjacent to this siting option (IER, 1985a)
		• disruption of day-to-day activities and/or the use and enjoyment of property (non-adjacent)	-3.6	• fourth most impacted; second highest number of residents in the site vicinity; potential number of residents affected by noise impact and visual intrusion are relatively low compared to the other siting options (IER, 1985a)
	• **Businesses**	• business activities negatively affected by the presence of OWMC facilities	-3.3	• number of businesses negatively affected is moderately high; annual sales ($2,192,000) and number of employees is moderately high (Clayton, 1985a)
		• business activities positively affected by the presence of OWMC facilities	+5.0	• large number of businesses and employees positively affected; estimated annual sales ($81.9 million) is high (Clayton, 1985a)
	• **Community and Recreation**	• disruption of operations of community and recreation features (adjacent to site)	-5.0	• greatest potential for impacts; two features adjacent (IER, 1985a)
		• disruption of operations of community and recreation features (site vicinity)	-4.0	• second most impacted; one feature in the noise impact zone and the feature is considered to be noise sensitive; highest number of features in the vicinity; second highest number of sensitive features (IER, 1985a)

TABLE C.6

Summary of Factor Suitability Levels

Siting Option - LF-1E/PI-27/E

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
SITE VICINITY	B. **ENVIRONMENTAL IMPACTS** - (Cont'd)			
	• **Land Use**	• existing land use	-3.6	• moderately high number of residences within 1000 m and the site vicinity but has substantial industrial land uses (LKA, 1985)
		• proposed and planned land use	-2.7	• has generally agricultural land use designations with substantial amounts of compatible industrial designations; official plan policies are protective of agricultural lands, but also promote industrial development; large numbers of vacant lots of record (LKA, 1985)
		• land use stability	-3.6	• moderate proportion of lands under absentee ownership; relatively few land sales (high constraint); no discernible trend in land values (moderate constraint) and a moderate percentage of buildings of good quality, indicating an overall level of moderate stability (LKA, 1985)
		• provincial policies and plans	0.0	• plans not applicable to LF-1E/PI-27E
	• **Agricultural Resources**	• partial displacement of farms (off-site farms with on-site land)	-3.6	• few small farm headquarters in the vicinity losing on-site land; proportion of those owned farms losing land is moderately high (Ecologistics, 1985)
		• disruption of adjacent farm operations	-2.8	• moderate number of farm with headquarters; moderate amount of owner-operated land; livestock density is moderate (Ecologistics, 1985)
		• disruption of non-adjacent farm operations	-2.4	• moderately large number of farms with headquarters; proportion land in crops and the livestock density are low (Ecologistics, 1985)

TABLE C.6

Summary of Factor Suitability Levels

Siting Option - LF-1E/PI-27/E

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
SITE VICINITY	B. **ENVIRONMENTAL IMPACTS** - (Cont'd)			
	• **Natural Environment**	• significant environmental units (SEUs)	-5.0	• approximately 636 ha, largest area of all siting options (GLAL, 1985a)
		• fish and wildlife features of significance	-5.0	• 4 features (GLAL, 1985a)
		• other natural vegetation	-5.0	• approximately 692 ha, largest area of all siting options (GLAL, 1985a)
		• rare species	-3.0	• low potential impact on rare plant species; high potential impact on rare animal species (GLAL, 1985a)
	• **Air Dispersion/ Air Quality**	• restraints to dispersion	-1.0	• no significant modifications (ORF, 1985)
		• existing and anticipated air quality	-5.0	• high constraint existing air quality; high constraint existing short-term air quality; low estimated effect on air quality - incinerator stack emissions; low estimated effect on air quality - fugitive emissions

TABLE C.6

Summary of Factor Suitability Levels

Siting Option - LF-1E/PI-27/E

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
COMMUNITY AND REGIONAL	B. ENVIRONMENTAL IMPACTS - (Cont'd)			
	• Community and Regional	• municipal finance	+2.3	• large increase in operating costs because of high levels of area municipal service; revenue increases are high due to higher tax rates and greater anticipated household growth; option requires two sites, greater reduced property taxes due to negative property values impacts
		• social stability	-5.0	• potentially most impacted; highest level of social stability; most disrupted through resident displacement; third most disrupted through voluntary out-migration of residents (IER, 1985a)
		• social cohesion	-4.6	• second highest impact on cohesion; second highest impact through resident displacement and resident out-migration (IER, 1985a)
		• community character	-3.8	• potentially least impacted; most compatible existing and proposed land use; least potential impact in terms of heritage features; second least impact in terms of visual compatibility (IER, 1985a)
		• community and regional economic base	+5.0	• number of new jobs created and households created are high; perceptions among community businesses balanced between positive and negative on possible effects of the facilities (Clayton, 1985a)
		• tourism economy	-5.0	• highest potential impact on tourism economy (Appendix E, Volume II)
		• tourism operations	-1.0	• highest potential impact on tourism operations (Appendix E, Volume II)

TABLE C.6

Summary of Factor Suitability Levels

Siting Option - LF-1E/PI-27/E

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
COMMUNITY AND REGIONAL	B. **ENVIRONMENTAL IMPACTS** - (Cont'd)			
	• **Land Use**	• existing land use	-3.3	• has significant amounts of residential land use, but this is largely offset by the substantial compatible industrial lands in the regional area (LKA, 1985)
		• proposed and planned land use	-2.6	• has generally agricultural lands with substantial amounts of compatible industrial designations; has considerable heavy industrial lands with official plan policies encouraging industrial development, but significant residential land use designation partially offsets advantages (LKA, 1985)
		• provincial policies and plans	0.0	• plans not applicable to LF-1E/PI-27E
	• **Agricultural Resources**	• stability of farm population	-2.6	• moderate percentage of operators are under 55 years of age, but there are few full-time operators (Ecologistics, 1985)
		• stability of agricultural land base	-2.8	• a low proportion of large land parcels; a low proportion of owned land and area farmed in the community; very low proportion of residences are farm residences and low number of Class 1 equivalents; amount of private land ownership is high (Ecologistics, 1985)
		• disruption to the farm economy	-1.3	• gross farm revenue is low; fugitive emission and stack emissions indices for livestock are both low; fugitive emissions indices for crops are moderately low and stack emission index for crops is moderate (Ecologistics, 1985)

TABLE C.6

Summary of Factor Suitability Levels

Siting Option - LP-1E/PI-27/E

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
ACCESS ROADS	B. **ENVIRONMENTAL IMPACTS** - (Cont'd)			
	• **Residents**	• disruption of day-to-day activities and/or the use and enjoyment of property (adjacent)	-0.1	• least impacted; least number of residents; lowest number of age sensitive residents (IER, 1985a)
		• disruption of day-to-day activities and/or the use and enjoyment of property (vicinity)	-0.1	• least impacted; least number of residents within the vicinity; the least number of residents within the noise impact zone (IER, 1985a)
	• **Community and Recreation Features**	• disruption of operations of community and recreation features (adjacent)	-0.1	• potentially least impacted; one feature adjacent, not considered significant (IER, 1985a)
		• disruption of operations of community and recreation features (vicinity)	-0.3	• potentially least impacted; one feature within the noise impact zone which is considered sensitive; has the fewest features in the vicinity and none are considered sensitive (IER, 1985a)
	• **Land Use**	• existing land uses	-0.9	• has few residences or commercial facilities and no residential land uses (LKA, 1985)
		• planned and proposed land uses	-0.6	• has no residential designations, no constraining official plan policies, no unapproved development proposals and a low number of vacant lots of record (LKA, 1985)
	• **Agricultural Resources**	• disruption to the farm traffic and cattle crossings	0.0	• negligible disruption along either regional or local roads (Ecologistics, 1985)

TABLE C.6

Summary of Factor Suitability Levels

Siting Option - LF-1E/PI-27/E

STUDY AREA	FACTOR GROUPING	FACTORS	SUITABILITY LEVEL	RATIONALE
ACCESS ROADS	B. ENVIRONMENTAL IMPACTS - (Cont'd)			
	• Agricultural Resources	• disruption to crop and livestock production	-0.1	• moderately low rating for adjacent crops; negligible impact on adjacent or downstream livestock (Ecologistics, 1985)
	• Natural Environment	• fish communities	-1.0	• zero length of both significant regional and local fisheries (GLAL, 1985a)

INTRODUCTION TO TABLE C.7

Response to Concerns Raised by the Public and Agencies Through Submissions and Meetings

The following table documents the response to each concern raised by the public or agencies in Phase 4A site selection. The list of concerns was developed by reviewing submissions to OWMC during Phase 4A and records of meetings held with the public and agencies. The table indicates if the concern was applied as a Phase 4A factor and if not, why it was screened from the analysis. Concerns which could be addressed by mitigation or compensation measures are also noted.

Public and agency inputs were also incorporated directly into the synthesis of differences and tradeoffs. The public and agency input into the differences and tradeoffs analysis was, in part, reflected in the factor rankings and factor suitability levels employed in the paired comparisons. It was also based on the review of OWMC files of public submissions and meetings. Table C.7 documents how each concern was used in identification of major risks or impacts for the synthesis of differences and tradeoffs. Outlined below are further details regarding the method used to identify major risks and impacts based on public and agency concerns.

In the differences and tradeoffs synthesis, the factor suitability levels (magnitude) and factor rankings (importance) were used to determine whether or not a major issue existed for each factor on a site-by-site basis. Public/agency input was also used to review these magnitude and importance considerations.

The issues raised by the public for each factor were reviewed for each siting option. In many cases the issues were already considered important by the site selection team. As a result, they had either high factor rankings (8, 9, 10) or high factor suitability levels (less than or equal to

-3.0 or greater than or equal to +3.0). In instances where a factor was not considered important for any siting option based on those criteria, the issues raised by the public for that factor were reviewed, as well as the frequency of public/agency concern. The following, Table C.7, documents the treatment of each concern raised by public in the identification of major issues for the paired comparisons.

TABLE C.7

Response to Concerns Raised by the Public and Agencies Through Submissions and Meetings

CONCERN RAISED BY PUBLIC	RESPONSE TO CONCERN RAISED IN SITE SELECTION					
	CONSIDERED AS GENERAL CONCERN (NOT FACTOR SPECIFIC)	CONSIDERED IN FACTOR REFINEMENT		CONSIDERATION IN IDENTIFICATION OF MAJOR RISKS OR IMPACTS TO COMPARE SITING OPTIONS		CONSIDERED AS MITIGATION AND/OR COMPENSATION
		Applied as Phase 4A Factor(s)	Reasons Factor Screened from Analysis	High Factor Rank*	Other	
Transportation						
• Increased truck traffic	X			X	• not related to a specific factor, but all transportation risk factors are highly ranked and therefore considered as major risks for all siting options	
Distance between waste generators and candidate site		X		X	• distance to siting options was a component of risk calculations for province-wide access system	
• Transportation spills/accidents		X		X	• all transportation risk factors for local and regional and province-wide access system are highly ranked	

* Risks and impacts for highly ranked factors considered as issues for all siting options

TABLE C.7

Response to Concerns Raised by the Public and Agencies Through Submissions and Meetings

CONCERN RAISED BY PUBLIC	RESPONSE TO CONCERN RAISED IN SITE SELECTION					
	CONSIDERED AS GENERAL CONCERN (NOT FACTOR SPECIFIC)	CONSIDERED IN FACTOR REFINEMENT		CONSIDERATION IN IDENTIFICATION OF MAJOR RISKS OR IMPACTS TO COMPARE SITING OPTIONS		CONSIDERED AS MITIGATION AND/OR COMPENSATION
		Applied as Phase 4A Factor(s)	Reasons Factor Screened from Analysis	High Factor Rank*	Other	
Transportation (cont'd)						
• Need for transportation regulations/safeguards						• to be addressed in Phase 4B
• Need for driver training programs						• to be addressed in Phase 4B
• Concern regarding higher accident rates in the Niagara Falls area during the tourist season		X		X	• accident risk factors highly ranked and include historic accident rates	
• Inclement weather causing driving hazard		X		X	• historic accident rates based on local conditions and considered for all highly ranked transportation accident factors	

TABLE C.7

Response to Concerns Raised by the Public and Agencies Through Submissions and Meetings

CONCERN RAISED BY PUBLIC	RESPONSE TO CONCERN RAISED IN SITE SELECTION					
	CONSIDERED AS GENERAL CONCERN (NOT FACTOR SPECIFIC)	CONSIDERED IN FACTOR REFINEMENT		CONSIDERATION IN IDENTIFICATION OF MAJOR RISKS OR IMPACTS TO COMPARE SITING OPTIONS		CONSIDERED AS MITIGATION AND/OR COMPENSATION
		Applied as Phase 4A Factor(s)	Reasons Factor Screened from Analysis	High Factor Rank*	Other	
Transportation (cont'd)						
° General concern with transportation	X			X	° all risks due to transportation are highly ranked	
° Traffic conflict with school buses			° information regarding bus routes was collected by IER, but was not used in the analysis because bus routes are subject to frequent change and all siting options had bus route conflicts. No difference between the options could be identified ° the information on school bus routes was used by IER in the evaluation of alternative access routes			
° Traffic conflict with farm vehicles		X		X		

* Risks and impacts for highly ranked factors considered as issues for all siting options

TABLE C.7

Response to Concerns Raised by the Public and Agencies Through Submissions and Meetings

CONCERN RAISED BY PUBLIC	RESPONSE TO CONCERN RAISED IN SITE SELECTION					
	CONSIDERED AS GENERAL CONCERN (NOT FACTOR SPECIFIC)	CONSIDERED IN FACTOR REFINEMENT		CONSIDERATION IN IDENTIFICATION OF MAJOR RISKS OR IMPACTS TO COMPARE SITING OPTIONS		CONSIDERED AS MITIGATION AND/OR COMPENSATION
		Applied as Phase 4A Factor(s)	Reasons Factor Screened from Analysis	High Factor Rank*	Other	
Transportation (cont'd)						
° Need for access route upgrading					° included in consideration of cost in site selection	
° Exhaust emissions from traffic are a concern		X			° is to be reviewed during Phase 4B based on original data verification	
				X	° "disruption to residents adjacent to access roads" factor assesses nuisance impacts on residents by comparing population levels along access routes	
° Dust effects along access routes		X		X	° see above	
° Impact of noise along access routes		X		X	° see above for adjacent residents	

TABLE C.7

Response to Concerns Raised by the Public and Agencies Through Submissions and Meetings

CONCERN RAISED BY PUBLIC	RESPONSE TO CONCERN RAISED IN SITE SELECTION					
	CONSIDERED AS GENERAL CONCERN (NOT FACTOR SPECIFIC)	CONSIDERED IN FACTOR REFINEMENT		CONSIDERATION IN IDENTIFICATION OF MAJOR RISKS OR IMPACTS TO COMPARE SITING OPTIONS		CONSIDERED AS MITIGATION AND/OR COMPENSATION
		Applied as Phase 4A Factor(s)	Reasons Factor Screened from Analysis	High Factor Rank*	Other	
Transportation (cont'd)					• number of residents within noise impact zone for access routes is an indicator for disruption to residents not adjacent to access routes (moderately ranked factor) • noise along access routes considered a major impact for LF-9C and LF-3C because of high magnitude of impact • frequency of concern regarding noise from the public is also considerably greater for West Lincoln options and LF-4N/PI-13N (frequency of occurrence is 4 to 7 for West Lincoln and LF-4N/PI-13N and 0 or 1 for other options)	

* Risks and impacts for highly ranked factors considered as issues for all siting options

TABLE C.7

Response to Concerns Raised by the Public and Agencies Through Submissions and Meetings

CONCERN RAISED BY PUBLIC	RESPONSE TO CONCERN RAISED IN SITE SELECTION					
	CONSIDERED AS GENERAL CONCERN (NOT FACTOR SPECIFIC)	CONSIDERED IN FACTOR REFINEMENT		CONSIDERATION IN IDENTIFICATION OF MAJOR RISKS OR IMPACTS TO COMPARE SITING OPTIONS		CONSIDERED AS MITIGATION AND/OR COMPENSATION
		Applied as Phase 4A Factor(s)	Reasons Factor Screened from Analysis	High Factor Rank*	Other	
Transportation (cont'd)					° therefore considered as a major impact for LF-4N/PI-13N	
° Impact of vibration of trucks along access routes		X			° see exhaust emissions from traffic above	
° Access route passes through a residential area		X		X	° all transportation risk factors are highly ranked, as is impact on adjacent residents ° non-adjacent populations and existing land use are also considered to be major impacts for siting options where impact is relatively high (LF-9C, LF-3C for non-adjacent residents and LF-9C, LF-3C, LF-4N/PI-1N, LF-4N/PI-13N for existing land use)	

* Risks and impacts for highly ranked factors considered as issues for all siting options

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		Applied as Phase 4A Factor(s)	Reasons Factor Screened from Analysis	High Factor Rank*	Other	
Transportation (cont'd)					° greatest frequency of public concern was for West Lincoln and LF-4N/PI-13N (frequency 8, 9 and 4) ° frequency is 0 or 1 for other options ° therefore, considered a major impact for LF-4N/PI-13N	
° Access route is presently heavily travelled		X		X	° risk to road users along local and regional access routes considered by transportation risk factors ° annual average daily traffic used to assess transportation risk from spills and accidents	

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		Applied as Phase 4A Factor(s)	Reasons Factor Screened from Analysis	High Factor Rank*	Other	
Transportation (cont'd)						
• Need for emergency service procedures to be developed						• to be addressed in Phase 4B
• Need to establish a clean-up fund in case of spill/accident						• to be addressed in Phase 4B
• Traffic conflict with animals on the highway		X (farm animals)	• traffic conflict with animals was considered, by the biology consultant, to be a minor concern for all siting options • issue was raised very rarely by the public	X	• disruption to cattle crossings is highly ranked factor	
• Stream crossings		X		X	• risk to surface water for local and regional roads was part of transportation risk factors	

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		Applied as Phase 4A Factor(s)	Reasons Factor Screened from Analysis	High Factor Rank*	Other	
Transportation (cont'd)						
° Railway crossings						X
° Conflict with airport			° considered in refinement of site boundaries and determination of stack height and used as a factor in Phase 3B ° no conflicts with any siting options remaining in Phase 4A after boundary refinement			
Air Quality						
° Effect of emissions on agriculture/farming (crops and livestock)		X		X	° considered as major risk for siting options where magnitude of risks due to human ingestion are relatively high (LF-9C, LF-3C, LF-4N/ PI-1N, LF-4N/PI-13N)	

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		Applied as Phase 4A Factor(s)	Reasons Factor Screened from Analysis	High Factor Rank*	Other	
Air Quality (cont'd)						
° Effect of emissions on surrounding population		X		X	° greatest frequency of concern by public is for West Lincoln and Milton siting options, but also a concern for Niagara Falls; therefore also considered as a major risk for Niagara Falls options (frequency was 7 to 23 across all options) ° disruption to the farm economy factor considers exposure to fugitive emissions for all options due to high factor rank	

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		Applied as Phase 4A Factor(s)	Reasons Factor Screened from Analysis	High Factor Rank*	Other	
Air Quality (cont'd)						
° Emissions will add to the acid rain problem			° contribution of OWMC facility to acid rain problem is considered negligible by the air quality consultant			
° Dispersion of emissions		X		X	° risk from inhalation of chronic emissions is highly ranked	
° Composition of emissions		X		X	° composition of emissions considered in air quality monitoring ° both risk from acute and chronic emissions (direct inhalation) are highly ranked	
° Monitor emissions						° to be addressed in Phase 4B

* Risks and impacts for highly ranked factors considered as issues for all siting options

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Response to Concerns Raised by the Public and Agencies Through Submissions and Meetings

CONCERN RAISED BY PUBLIC	RESPONSE TO CONCERN RAISED IN SITE SELECTION					
	CONSIDERED AS GENERAL CONCERN (NOT FACTOR SPECIFIC)	CONSIDERED IN FACTOR REFINEMENT		CONSIDERATION IN IDENTIFICATION OF MAJOR RISKS OR IMPACTS TO COMPARE SITING OPTIONS		CONSIDERED AS MITIGATION AND/OR COMPENSATION
		Applied as Phase 4A Factor(s)	Reasons Factor Screened from Analysis	High Factor Rank*	Other	
Air Quality (cont'd)						
° Synergistic effect of combining wastes		X		X	° mixing of incompatible wastes considered for acute emissions ° worst case assumptions used in emissions calculations	
Effect of emissions on surface water (lakes, rivers, cisterns)		X (cisterns and ponds)	° effects on lakes and rivers expected to be minimal		° risk from ingestion of cistern and pond water is considered a major risk for LF-1E because the magnitude of risk is relatively high and is considered a major risk for the West Lincoln options because it is a frequently noted public concern (11 to 21 occurrences)	

* Risks and impacts for highly ranked factors considered as issues for all siting options

TABLE C.7

Response to Concerns Raised by the Public and Agencies Through Submissions and Meetings

CONCERN RAISED BY PUBLIC	RESPONSE TO CONCERN RAISED IN SITE SELECTION					
	CONSIDERED AS GENERAL CONCERN (NOT FACTOR SPECIFIC)	CONSIDERED IN FACTOR REFINEMENT		CONSIDERATION IN IDENTIFICATION OF MAJOR RISKS OR IMPACTS TO COMPARE SITING OPTIONS		CONSIDERED AS MITIGATION AND/OR COMPENSATION
		Applied as Phase 4A Factor(s)	Reasons Factor Screened from Analysis	High Factor Rank*	Other	
Air Quality (cont'd)					° for other options, frequency of public concern and magnitude of impact are relatively low (frequency of concern is 1 to 3)	
° Effect of emissions on local area		X			° effect on existing and anticipated air quality is an important public concern for all options (frequency ranged from 5 to 20) and was therefore considered as a major risk for all siting options	
° Contamination of sensitive crops		X			° considered a major risk or impact for siting options where magnitude of potential impacts on farm economy or risks to human health through ingestion	

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CONCERN RAISED BY PUBLIC	RESPONSE TO CONCERN RAISED IN SITE SELECTION					
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		Applied as Phase 4A Factor(s)	Reasons Factor Screened from Analysis	High Factor Rank*	Other	
Air Quality (cont'd)					of crops and livestock are relatively high (LF-9C, LF-3C, LF-4N/ PI-1N, LF-4N/PI-13N) • greatest frequency of concern by public is for West Lincoln and Niagara Falls siting options (frequency of concern is 2 or 3 versus 0 for Milton) and, therefore, considered as a major risk and impact for LF-1E and LF-1E/PI-27E	
• Concerned with malfunction of facility		X		X	• risk due to direct inhalation of acute emissions highly ranked	X
Water Contamination						
• Contamination of surface water (lakes, rivers, streams, creeks)		X			• the West Lincoln and Milton options have a	

* Risks and impacts for highly ranked factors considered as issues for all siting options

TABLE C.7

Response to Concerns Raised by the Public and Agencies Through Submissions and Meetings

	RESPONSE TO CONCERN RAISED IN SITE SELECTION					
		CONSIDERED IN FACTOR REFINEMENT		CONSIDERATION IN IDENTIFICATION OF MAJOR RISKS OR IMPACTS TO COMPARE SITING OPTIONS		
CONCERN RAISED BY PUBLIC	CONSIDERED AS GENERAL CONCERN (NOT FACTOR SPECIFIC)	Applied as Phase 4A Factor(s)	Reasons Factor Screened from Analysis	High Factor Rank*	Other	CONSIDERED AS MITIGATION AND/OR COMPENSATION
Water Contamination (cont'd)					relatively high magnitude of risk to surface water users and this is therefore considered a major risk ° the Niagara Falls siting options have a lower potential risk, but high public concern (frequency of occurrence is 13 and 14 versus 2 to 10 for other options) regarding surface water contamination (Grassy Brook, Lyons Creek and Welland River); therefore, considered a major risk for these options as well	
° Contamination of well water		X			° considered as a major risk for all options because magnitude of potential impacts is high	

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		Applied as Phase 4A Factor(s)	Reasons Factor Screened from Analysis	High Factor Rank*	Other	
Water Contamination (cont'd)					for all options, except LF-3C, and well water contamination is a public concern for all siting options (frequency of occurrence is 5 to 26)	
° Need to monitor water quality/ supply						° to be addressed in Phase 4B
° Presence of aquifer should be considered		X			° ground water use factor considered presence and use of aquifer and was treated as a major risk for all options (see above)	
Hydrogeology						
° Concerned with hydrogeologic/ geologic factors	X			X		

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Response to Concerns Raised by the Public and Agencies Through Submissions and Meetings

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		Applied as Phase 4A Factor(s)	Reasons Factor Screened from Analysis	High Factor Rank*	Other	
Hydrogeology (cont'd)						
° Concerned with the depth of clay		X		X		
° Concerned with the possible breakdown of the clay		X		X		
° Concerned with presence of fractures or seams		X		X		
° Concerned that the water table is too high		X		X		
° Concerned with contamination of ground water due to leakage, see page, leaching		X		X		
° Concerned with presence of natural gas and gas well		X		X	° considered in geologic and hydrogeologic studies	

* Risks and impacts for highly ranked factors considered as issues for all siting options

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		Applied as Phase 4A Factor(s)	Reasons Factor Screened from Analysis	High Factor Rank*	Other	
Impacts on Residents						
° Concerned about the long-term health and safety of residents	X				° many risk and impact factors relate to this concern	
° Need for monitoring of health						° to be addressed in Phase 4B
Need for compensation program for future health problems						° to be addressed in Phase 4B
° Concerned with adding to existing high cancer rates			° estimated risks of cancer are extremely low (to be supplemented by Environ)			° to be addressed further in Phase 4B

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		Applied as Phase 4A Factor(s)	Reasons Factor Screened from Analysis	High Factor Rank*	Other	
Impacts on Residents (cont'd)						
° Concern with visual impact of the incinerator stack		X		X	° visual intrusion considered for disruption of non-adjacent residents and community character factors (both are highly ranked)	
° Concern with devaluation of property		X			° high magnitude of impact for Milton only, but considered as a major impact for all siting options because relatively high frequency of public concern for all siting options (frequency of concern 7 to 17)	
° Need for compensation to surrounding landowners due to devaluation						X

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		Applied as Phase 4A Factor(s)	Reasons Factor Screened from Analysis	High Factor Rank*	Other	
Impacts on Residents (cont'd)						
° Concerned with noise and light impact from the facility		X		X	° disruption of residents adjacent and non-adjacent to site are highly ranked factors	
° Psychological impact of OWMC on the host community			° perceived impacts were found to be similar for all siting options and, therefore, could not be used for comparative purposes			
° Need for compensation due to spill/accident/explosion						° will be considered in Phase 4B

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		Applied as Phase 4A Factor(s)	Reasons Factor Screened from Analysis	High Factor Rank*	Other	
Community and Recreation Features						
° Proximity to schools, church/ cemetery, senior citizens' housing, hospitals, historic features, recreation and conservation area		X			° proximity to community and recreation features was one of public concerns noted for all siting options (frequency of concern 7 to 31); therefore, considered as a major impact for all siting options ° community character factor considered heritage features and was highly ranked ° no features were noted by the public that had not been considered by the site selection consultants	

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		Applied as Phase 4A Factor(s)	Reasons Factor Screened from Analysis	High Factor Rank*	Other	
Agriculture						
° Preservation of agricultural land/farming and preservation of fruitlands		X		X	° six factors concerned with preservation of agriculture off-site are highly ranked ° two factors concerned with displacement of farms and land are not highly ranked, but magnitude of impact relatively high for LF-4N/PI-1N, LF-4N/PI-13N, LF-1E and LF-3C ° public concern regarding preservation of farmland is relatively high for all siting options (frequency of concern is 11 to 26); therefore displacement considered as an major impact for LF-9C and LF-1E /PI-27E, although magnitude of impact is relatively low	

* Risks and impacts for highly ranked factors considered as issues for all siting options

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		Applied as Phase 4A Factor(s)	Reasons Factor Screened from Analysis	High Factor Rank*	Other	
Agriculture (cont'd)						
° Devaluation of farm products		X		X		
° Invasion of rural/agricultural life		X		X		
Land Use						
Concern regarding future developments		X			° proposed and planned land use is a major impact for the site and site vicinity study areas for all siting options except LF-1E/PI-27E based on magnitude of impact. This is supported by public concern for Milton and West Lincoln (frequency of concern 1 and 6)	

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		Applied as Phase 4A Factor(s)	Reasons Factor Screened from Analysis	High Factor Rank*	Other	
Land Use (cont'd)					° future land use is not a major impact for Niagara Falls, based on magnitude of impact, for the community and regional or access roads study areas, and is not a public issue (0 frequency of occurrence) ° future land use is a major impact for these study areas for Milton and West Lincoln based on relative magnitude of impact	
° By-law or official plan violation		X			° see above for future land use	
° The OWMC facility should not be located in an expanding urban area		X			° see above for future land use	

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		Applied as Phase 4A Factor(s)	Reasons Factor Screened from Analysis	High Factor Rank*	Other	
Land Use (cont'd)						
° The OWMC facility should be located in an industrial area		X			° see above for future land use ° existing land use is considered for the site vicinity for all siting options and for other study areas where the magnitude of impacts is relatively high; this approach addresses public concern which was noted for Milton only (frequency of 3)	
° General concerns with land use	X				° see above discussions for land use concerns	

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		Applied as Phase 4A Factor(s)	Reasons Factor Screened from Analysis	High Factor Rank*	Other	
Economic Impacts						
° See also property devaluation impacts on residents						
° Concern with impact of the facility on municipal and regional services		X			° positive impacts on municipal finance are a major impact for the West Lincoln options only, based on magnitude of impacts ° no negative impacts on servicing will occur for Niagara Falls where public concern noted (frequency 1) (Clayton, 1985a)	
° OWMC facility will attract industry			° applied as a sensitivity analysis by the economic consultant in Phase 4A		° potential for industrial spin-off considered in a sensitivity analysis for all siting opitons by the economic consultant	

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		Applied as Phase 4A Factor(s)	Reasons Factor Screened from Analysis	High Factor Rank*	Other	
Economic Impacts (cont'd)					(Clayton, 1985a, Appendix F)	
° OWMC impact on tourism		X			° tourism impacts were considered as a major impact for the Niagara Falls siting options which are the options for which public concern was high (frequency 49 versus frequency 0 and 2 for West Lincoln and Milton options) and magnitude of impact relatively high	
Natural Environment						
° Concern with impact on wildlife and natural habitats	X				° there is some concern regarding wildlife and natural habitats for all siting options (frequency of concern ranges from 1 to 6); five factors	

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		Applied as Phase 4A Factor(s)	Reasons Factor Screened from Analysis	High Factor Rank*	Other	
Natural Environment (cont'd)					address this concern and wildlife and natural habitats are considered as major impacts where the magnitude of impact is relatively high (LF-3C, LF-1E, LF-9C, LF-1E/PI-27E) and for the Milton options based on public concern (frequency of concern 2 and 5)	
• Rare and endangered species		X			• public concern regarding rare species is relatively low for all siting options (frequency of concern is 0 to 2), but this is considered as a major impact for all siting options based on magnitude of potential impact for site and/or site vicinity	

TABLE C.7

Response to Concerns Raised by the Public and Agencies Through Submissions and Meetings

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CONCERN RAISED BY PUBLIC		Applied as Phase 4A Factor(s)	Reasons Factor Screened from Analysis	High Factor Rank*	Other	
Natural Environment (cont'd)						
° Concern regarding impact on trapping			° this factor was screened from the analysis because there is not a significant resource base in an area the size of the siting options, it is not a significant impact issue, impacts will be of local consequence and activity on sites is similar to extensive areas surrounding the sites (GLAL, 1985)			
° Ensure proper management of forested areas						° will be considered in Phase 4B
° Impact on environmentally sensitive areas, such as SEUs, is a concern		X			° SEUs were considered a major impact for Niagara Falls' siting options based on magnitude of impacts	

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		Applied as Phase 4A Factor(s)	Reasons Factor Screened from Analysis	High Factor Rank*	Other	
Natural Environment (cont'd)					public concern was also noted for this factor for the other siting options and was, therefore, considered a major impact for all siting options (frequency of concern from 2 to 4)	
chaeology		X			° public concern for Niagara Falls (frequency of concern 1) and LF-3C (frequency of concern 5), but considered to be mitigable in site selection process and, therefore, not viewed as a major impact for any siting option	
Facility Operations						
° Concerned with facility operations						X

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		Applied as Phase 4A Factor(s)	Reasons Factor Screened from Analysis	High Factor Rank*	Other	
Facility Operations (cont'd)						
° Need for in-plant emergency procedures						X
° Need for monitoring of the facility						° to be considered in Phase 4B
Need for in-plant training program						° to be considered in Phase 4B

* Risks and impacts for highly ranked factors considered as issues for all siting options

TABLE C.8

Issues Raised in Site Selection by the Public and Agencies -
Relationship to Site Selection Factors and Frequency of Occurrence

STUDY AREA	FACTOR GROUPING	SITE SELECTION FACTORS	SITE SELECTION ISSUES	FREQUENCY OF OCCURRENCE													
				LF-3C		LF-9C		LF-1E		LF-1E/PI-27E		LF-4N/PI-1N		LF-4N/PI-13N		GENERAL	
				S[1]	M[2]	S	M	S	M	S	M	S	M	S	M	S	M
	A. **RISK**																
	• **Transportation**	• annual province-wide hazard-based spill index of OWMC generated transport	• distance between waste generators and candidate site	5	1	2	1	4	7	4	7	0	0	0	0	1	0
			• access route is presently heavily travelled	1	2	1	1	0	1	0	1	3	0	2	0		
			• transportation spills/ accidents	17	1	17	1	14	10	14	10	12	6	13	6	1	3
			• railway crossings	0	0	0	0	0	0	0	0	1	0	1	0		
			• inclement weather (frequent occurrence of fog, slippery roads)	5	3	5	2	0	1	0	1	0	1	0	1		
		• annual province-wide accident involvements of OWMC generated transport	• distance between waste generators and candidate site	5	1	2	1	4	7	4	7	0	0	0	0	1	0
			• railway crossings	0	0	0	0	0	0	0	0	1	0	1	0		
			• transportation spills/ accidents	17	1	17	1	14	10	14	10	12	6	13	6	1	3
			• inclement weather (frequent occurrence of fog, slippery roads)	5	3	5	2	0	1	0	1	0	1	0	1		
			• access route is presently heavily travelled	1	2	1	1	0	1	0	1	3	0	2	0		
		• transportation risk on local and regional access roads due to accident involvements of OWMC generated transport	• transportation spills/ accidents	17	1	17	1	14	10	14	10	12	6	13	6	1	3
			• inclement weather (frequent occurrence of fog, slippery roads)	5	3	5	2	0	1	0	1	0	1	0	1		

[1] S = submissions from the public or agencies
[2] M = meetings with the public or agencies

TABLE C.8

Issues Raised in Site Selection by the Public and Agencies -
Relationship to Site Selection Factors and Frequency of Occurrence

STUDY AREA	FACTOR GROUPING	SITE SELECTION FACTORS	SITE SELECTION ISSUES	FREQUENCY OF OCCURRENCE LF-3C		LF-9C		LF-1E		LF-1E/PI-27E		LF-4N/PI-1N		LF-4N/PI-13N		GENERAL	
				S^1	N^2	S	N	S	N	S	N	S	N	S	N	S	N
	A. **RISK** (cont'd)																
	• **Transportation** (cont'd)		• concerned about higher accident rates in the Niagara Falls area during the tourist season	0	0	0	0	2	1	2	1	0	0	0	0	0	1
			• railway crossings	0	0	0	0	0	0	0	0	1	0	1	0		
		• transportation risks on local and regional access roads due to hazard-based spills of OWMC generated transport	• transportation spills/ accidents	17	1	17	1	14	10	14	10	12	6	13	6	1	3
			• railway crossings	0	0	0	0	0	0	0	0	1	0	1	0		
			• concerned about higher accident rates during the tourist season	0	0	0	0	2	1	2	1	0	0	0	0	0	1
			• inclement weather (frequent occurrence of fog, slippery roads)	5	3	5	2	0	1	0	1	0	1	0	1		
	• **Air Quality**	• risk from direct inhalation of emissions - chronic	• effect of emissions on surrounding population	5	0	5	0	4	1	4	1	7	1	9	3		
			• dispersion of emissions	3	2	0	2	0	4	0	4	1	1	1	1	2	0
			• composition of emissions	4	1	1	2	1	1	1	1	0	2	0	2	1	1
			• synergistic affect of combining wastes	0	0	0	1	1	1	1	1	0	0	0	0		
		• risk from direct inhalation of emissions - acute	• effect of emissions of surrounding population	5	0	5	0	4	1	4	1	7	1	9	3		
			• concerned with a facility malfunction (explosion)	0	0	0	0	2	4	2	4	4	3	5	3	1	1
			• dispersion of emissions	3	2	0	2	0	4	0	4	1	1	1	1	2	0
			• synergistic effect of combining wastes	0	0	0	1	1	1	1	1	0	0	0	0		

TABLE C.8

Issues Raised in Site Selection by the Public and Agencies -
Relationship to Site Selection Factors and Frequency of Occurrence

STUDY AREA	FACTOR GROUPING	SITE SELECTION FACTORS	SITE SELECTION ISSUES	FREQUENCY OF OCCURRENCE													
				LF-3C		LF-9C		LF-1E		LF-1E/PI-27E		LF-4N/PI-1N		LF-4N/PI-13N		GENERAL	
				S[1]	N[2]	S	N	S	N	S	N	S	N	S	N	S	N
	A. **RISK** (cont'd)																
	• **Air Quality** (cont'd)	• risks from ingestion of cistern and pond water	• effect of emissions on surface water (lakes, rivers and cisterns)	19	2	9	2	2	1	2	1	1	0	1	0		
		• risks from consumption of crops and livestock	• effect of emissions on agricultural/farming (crops and livestock)	14	2	8	2	5	2	5	2	14	3	16	7		
			• contamination of specialty/sensitive crops	3	0	2	0	2	0	2	0	0	0	0	0		
	• **Hydrogeologic Suitability**	• capability of providing natural containment	• concerned with hydrogeological/geological factors	1	1	1	2	4	0	4	0	2	0	5	0	2	0
			• concerned with depth of clay	0	0	0	0	1	0	1	0	0	0	1	0		
			• concerned with the possibility of breakdown of the clay	1	0	1	1	0	1	0	1	1	0	1	0		
			• presence of fractures/seams	0	0	1	0	1	1	1	1	0	0	1	0		
			• water table is too high	0	0	0	0	0	1	0	1	1	0	1	0		
			• contamination of ground water due to leakage/seepage/leaching	11	1	11	2	17	3	17	3	5	4	6	5		
			• presence of natural gas	0	0	0	0	2	0	2	0	0	0	0	0		
			• proximity to gas wells	0	0	0	0	1	0	1	0	0	0	0	0		
		• ground water use	• contamination of well water	9	0	7	0	4	1	4	1	22	2	24	2		
			• presence of aquifer	0	1	0	1	0	0	0	0	0	0	0	0		

TABLE C.8

Issues Raised in Site Selection by the Public and Agencies - Relationship to Site Selection Factors and Frequency of Occurrence

STUDY AREA	FACTOR GROUPING	SITE SELECTION FACTORS	SITE SELECTION ISSUES	FREQUENCY OF OCCURRENCE													
				LF-3C		LF-9C		LF-1E		LF-1E/PI-27E		LF-4N/PI-1N		LF-4N/PI-13N		GENERAL	
				S[1]	N[2]	S	N	S	N	S	N	S	N	S	N	S	N
	A. **RISK** (cont'd)																
	• **Surface Water Suitability**	• susceptibility of site to flooding	• flooding concerns	9	3	0	2	0	1	0	1	0	2	0	3		
		• potential for water use interference	• contamination of surface water (lakes, rivers, streams, creeks)	7	2	2	0	8	5	9	5	3	5	3	7	0	1

TABLE C.8

Issues Raised in Site Selection by the Public and Agencies - Relationship to Site Selection Factors and Frequency of Occurrence

STUDY AREA	FACTOR GROUPING	SITE SELECTION FACTORS	SITE SELECTION ISSUES	FREQUENCY OF OCCURRENCE													
				LF-3C		LF-9C		LF-1E		LF-1E/PI-27E		LF-4W/PI-1W		LF-4W/PI-13W		GENERAL	
				S[1]	M[2]	S	M	S	M	S	M	S	M	S	M	S	M
SITE	B. **ENVIRONMENTAL IMPACTS**																
	• **Residents**	• displacement of residents	-	-	-	-	-	-	-	-	-	-	-	-	-		
	• **Businesses**	• displacement of businesses	-	-	-	-	-	-	-	-	-	-	-	-	-		
	• **Community and Recreation Features**	• displacement of historical, community and recreation features	-	-	-	-	-	-	-	-	-	-	-	-	-		
		• archaeological resources	• impact on archaeological finds	1	4	0	0	1	0	1	0	0	0	0	0		
	• **Land Use**	• existing land use	• the OWMC facility should be located in an industrial area	5	1	2	1	1	1	1	1	1	4	2	4	0	1
		• proposed and planned land uses	• by-law, official plan violation	0	1	0	1	1	1	1	1	0	4	0	4		
		• land use stability	-	-	-	-	-	-	-	-	-	-	-	-	-		
	• **Agricultural Resources**	• displacement of farms with on-site headquarters	• preservation of prime agricultural/farming land	14	1	11	1	10	2	10	2	9	2	10	2	2	0
			• preservation of fruitlands	10	1	9	0	5	1	5	1	0	0	0	0		
		• loss of farmland	• preservation of prime agricultural/farming land	14	1	11	1	10	2	10	2	9	2	10	2	2	0
			• preservation of fruitlands	10	1	9	0	5	1	5	1	0	0	0	0		

TABLE C.8

Issues Raised in Site Selection by the Public and Agencies -
Relationship to Site Selection Factors and Frequency of Occurrence

STUDY AREA	FACTOR GROUPING	SITE SELECTION FACTORS	SITE SELECTION ISSUES	FREQUENCY OF OCCURRENCE													
				LF-3C		LF-9C		LF-1E		LF-1E/PI-27E		LF-4N/PI-1N		LF-4N/PI-13N		GENERAL	
				S^1	N^2	S	N	S	N	S	N	S	N	S	N	S	N
SITE (continued)	B. **ENVIRONMENTAL IMPACTS**																
	• **Natural Environment**	• rare species	• impact on rare and endangered species	0	0	0	0	1	0	1	0	1	1	1	1		
		• natural vegetation displaced	• impact on wildlife and natural habitats	6	0	1	0	1	1	2	1	2	0	4	1		
		• potential for occurrence of other significant features	• impact on wildlife and natural habitats	0	0	1	0	1	1	2	1	2	0	4	1		

TABLE C.8

Issues Raised in Site Selection by the Public and Agencies -

Relationship to Site Selection Factors and Frequency of Occurrence

STUDY AREA	FACTOR GROUPING	SITE SELECTION FACTORS	SITE SELECTION ISSUES	FREQUENCY OF OCCURRENCE LF-3C		LF-9C		LF-1E		LF-1E/PI-27E		LF-4N/PI-1N		LF-4N/PI-13N		GENERAL	
				S[1]	M[2]	S	M	S	M	S	M	S	M	S	M	S	M
SITE VICINITY	B. ENVIRONMENTAL IMPACTS																
	• Residents	• property value impacts	• devaluation of property	12	1	6	1	6	2	6	3	9	3	10	7		
		• disruption of use and enjoyment of property and/or day-to-day activities (adjacent to site)	• odour	1	1	1	1	0	4	0	4	0	0	0	1		
			• noise and light from the facility	0	0	0	0	0	0	0	0	0	1	2	1		
			• impact on historic buildings/ communities	1	4	0	0	1	0	2	0	2	0	2	0		
		• disruption of use and enjoyment of property and/or day-to-day activities (non-adjacent)	• odour	1	1	1	1	0	4	0	4	0	0	0	1		
			• visual impact of the incinerator stack	0	0	0	0	0	0	0	0	4	7	5	7	8	1
			• noise and light from the facility	0	0	0	0	0	0	0	0	0	1	2	1		
			• impact on historic buildings/ communities	1	4	0	0	1	0	2	0	2	0	2	0		
	• Businesses	• business activities negatively affected by the presence of OWMC facilities	-	-	-	-	-	-	-	-	-	-	-	-	-		
		• business activities positively affected by the presence of OWMC facilities	-	-	-	-	-	-	-	-	-	-	-	-	-		
	• Community and Recreation Features	• disruption of operations of community and recreation features (adjacent to site)	• proximity to schools	10	3	6	2	0	0	0	0	2	0	6	2		
			• proximity to church/cemetery	8	1	3	1	1	0	1	0	1	0	1	1		

TABLE C.8

Issues Raised in Site Selection by the Public and Agencies - Relationship to Site Selection Factors and Frequency of Occurrence

STUDY AREA	FACTOR GROUPING	SITE SELECTION FACTORS	SITE SELECTION ISSUES	FREQUENCY OF OCCURRENCE													
				LF-3C		LF-9C		LF-1E		LF-1E/PI-27E		LF-4N/PI-1N		LF-4N/PI-13N		GENERAL	
				S[1]	M[2]	S	M	S	M	S	M	S	M	S	M	S	M
SITE VICINITY (continued)	B. ENVIRONMENTAL IMPACTS																
	• Community and Recreation Features (cont'd)		• proximity to senior citizens' housing	1	0	2	0	0	0	0	0	1	0	1	0		
			• proximity to hospitals	0	0	0	0	0	0	0	0	3	2	3	2		
			• noise and light from the facility	0	0	0	0	0	0	0	0	0	1	2	1		
			• impacts on historic buildings/communities	1	4	0	0	1	0	2	0	2	0	2	0		
			• proximity to recreation/ conservation area	2	1	1	1	0	4	0	4	2	1	2	2		
		• disruption of operations of community and recreation features (site vicinity)	• proximity to schools	10	3	6	2	0	0	0	0	2	0	6	2		
			• proximity to church/cemetery	8	1	3	1	1	0	1	0	1	0	1	1		
			• proximity to senior citizens' housing	1	0	2	0	0	0	0	0	1	0	1	0		
			• proximity to hospitals	0	0	0	0	0	0	0	0	3	2	3	2		
			• noise and light from the facility	0	0	0	0	0	0	0	0	0	1	2	1		
			• impacts on historic buildings/communities	1	4	0	0	1	0	2	0	2	0	2	0		
			• proximity to recreation/ conservation area	2	1	1	1	0	4	0	4	2	1	2	2		
	• Land Use	• existing land use	• the OWMC facility should not be located in the middle of an expanding urban area	0	0	0	0	0	0	0	0	3	0	3	0		
			• the OWMC facility should be located in an industrial area	5	1	2	1	1	1	1	1	1	4	2	4	0	1

TABLE C.8

Issues Raised in Site Selection by the Public and Agencies - Relationship to Site Selection Factors and Frequency of Occurrence

STUDY AREA	FACTOR GROUPING	SITE SELECTION FACTORS	SITE SELECTION ISSUES	FREQUENCY OF OCCURRENCE													
				LF-3C		LF-9C		LF-1E		LF-1E/PI-27E		LF-4W/PI-1W		LF-4W/PI-13W		GENERAL	
				S[1]	M[2]	S	M	S	M	S	M	S	M	S	M	S	M
SITE VICINITY (continued)	B. ENVIRONMENTAL IMPACTS																
	• Land Use (cont'd)	• proposed and planned land use	• proximity to future developments	0	1	0	1	0	0	0	0	3	3	3	3		
			• the UWMC facility should not be located in the middle of an expanding urban area	0	0	0	0	0	0	0	0	3	0	3	0		
		• land use stability	-	-	-	-	-	-	-	-	-	-	-	-	-		
		• provincial policies and plans	-	-	-	-	-	-	-	-	-	-	-	-	-		
	• Agricultural Resources	• partial displacement of farms (off-site farms with on-site land)	-	-	-	-	-	-	-	-	-	-	-	-	-		
		• disruption of adjacent farm operations	• preservation of prime agricultural/farming land	14	1	11	1	10	2	10	2	9	2	10	2	2	0
			• preservation of fruitlands	10	1	9	0	5	1	5	1	0	0	0	0		
		• disruption of non-adjacent vicinity farm operations	• preservation of prime agricultural/farming land	14	1	11	1	10	2	10	2	9	2	10	2	2	0
			• preservation of fruitlands	10	1	9	0	5	1	5	1	0	0	0	0		
	• Natural Environment	• Significant Environmental Units (SEUs)	• impacts upon wildlife and natural habitats	6	0	1	0	1	1	2	1	2	0	4	1		
			• UWMC impact on environmentally sensitive areas such as SEUs	3	0	2	0	1	0	1	0	2	0	4	0		
		• fish and wildlife features of significance	• impact on wildlife and natural habitats	6	0	1	0	1	1	2	1	2	0	4	1		

TABLE C.8

Issues Raised in Site Selection by the Public and Agencies –

Relationship to Site Selection Factors and Frequency of Occurrence

STUDY AREA	FACTOR GROUPING	SITE SELECTION FACTORS	SITE SELECTION ISSUES	FREQUENCY OF OCCURRENCE													
				LF-3C		LF-4C		LF-1E		LF-1E/PI-27E		LF-4N/PI-1N		LF-4N/PI-13N		GENERAL	
				S^1	M^2	S	M	S	M	S	M	S	M	S	M	S	M
SITE VICINITY (continued)	B. **ENVIRONMENTAL IMPACTS**																
	• **Natural Environment** (cont'd)	• other natural vegetation	• impact on wildlife and natural habitats	6	0	1	0	1	1	2	1	2	0	4	1		
		• rare species	• impact on rare and endangered species	0	0	0	0	1	0	1	0	1	1	1	1		
	• **Air Dispersion/ Air Quality**	• restraints to dispersion	• dispersion of emissions	3	2	0	2	0	4	0	4	1	1	1	2	2	0
		• existing and anticipated air quality	• effect of emissions on the local area (i.e. air pollution)	5	0	5	0	12	7	13	7	12	1	13	2	1	0

TABLE C.8

Issues Raised in Site Selection by the Public and Agencies -

Relationship to Site Selection Factors and Frequency of Occurrence

STUDY AREA	FACTOR GROUPING	SITE SELECTION FACTORS	SITE SELECTION ISSUES	FREQUENCY OF OCCURRENCE													
				LF-3C		LF-9C		LF-1E		LF-1E/PI-27E		LF-4N/PI-1N		LF-4N/PI-13N		GENERAL	
				S[1]	M[2]	S	M	S	M	S	M	S	M	S	M	S	M
COMMUNITY AND REGIONAL	B. ENVIRONMENTAL IMPACTS • Community and Regional	• municipal finance	• impact of the facility on municipal and regional services	0	0	0	[illegible]	0	1	0	1	0	0	0	0		
		• social stability	• invasion of rural/ agricultural life	14	1	8	2	1	0	1	0	9	0	11	1	1	0
		• social cohesion	• invasion of rural/ agricultural life	14	1	8	2	1	0	1	0	9	0	11	1	1	0
		• community character	• visual impact of the incinerator stack	0	0	0	0	0	0	0	0	4	7	5	7	0	1
			• impact on historic buildings/ communities	1	4	0	0	1	0	2	0	2	0	2	0		
		• regional and community economic base	• OWMC facility will attract industry	2	0	1	0	1	0	1	0	2	2	2	2		
		• tourism economy	• OWMC impact on tourism	0	0	0	0	22	27	22	27	0	1	0	1	0	2
		• tourism operations	• OWMC impact on tourism	0	0	0	0	22	27	22	27	0	1	0	1	0	2
	• Land Use	• existing land use	• the OWMC facility should not be located in the middle of an expanding urban area	0	0	0	0	0	0	0	0	3	0	3	0		
			• the OWMC facility should be located in an industrial area	5	1	2	1	1	1	1	1	1	4	2	4	0	1

TABLE C.8

Issues Raised in Site Selection by the Public and Agencies -
Relationship to Site Selection Factors and Frequency of Occurrence

STUDY AREA	FACTOR GROUPING	SITE SELECTION FACTORS	SITE SELECTION ISSUES	FREQUENCY OF OCCURRENCE													
				LF-3C		LF-9C		LF-1E		LF-1E/PI-27E		LF-4N/PI-1N		LF-4N/PI-13N		GENERAL	
				S[1]	M[2]	S	M	S	M	S	M	S	M	S	M	S	M
COMMUNITY AND REGIONAL (continued)	B. **ENVIRONMENTAL IMPACTS**																
	• **Land Use** (cont'd)	• proposed and planned land use	• proximity to future developments	0	1	0	1	0	0	0	0	3	3	3	3		
			• the OWMC facility should not be located in the middle of an expanding urban area	0	0	0	0	0	0	0	0	3	0	3	0		
		• provincial policies and plans	-	-	-	-	-	-	-	-	-	-	-	-	-		
	• **Agricultural Resources**	• stability of farm population	• preservation of prime agricultural/farming land	14	1	11	1	10	2	10	2	9	2	10	2	2	0
			• preservation of fruitlands	10	1	9	0	5	1	5	1	0	0	0	0		
			• invasion of rural/agricultural life	14	1	8	2	1	0	1	0	9	0	11	1	1	0
		• stability of agricultural land base	• preservation of prime agricultural/farming land	14	1	11	1	10	2	10	2	9	2	10	2	2	0
			• preservation of fruitlands	10	1	9	0	5	1	5	1	0	0	0	0		
			• invasion of rural/agricultural life	14	1	8	2	1	0	1	0	9	0	11	1	1	0
		• disruption to the farm economy	• preservation of prime agricultural/farming land	14	1	11	1	10	2	10	2	9	2	10	2	2	0
			• contamination of special/sensitive crops	3	0	2	0	2	0	2	0	0	0	0	0		
			• devaluation of farm products	5	0	2	0	3	1	3	1	0	0	1	0		
			• preservation of fruitlands	10	1	9	0	5	1	5	1	0	0	0	0		

TABLE C.8

Issues Raised in Site Selection by the Public and Agencies - Relationship to Site Selection Factors and Frequency of Occurrence

STUDY AREA	FACTOR GROUPING	SITE SELECTION FACTORS	SITE SELECTION ISSUES	FREQUENCY OF OCCURRENCE LF-3C		LF-9C		LF-1E		LF-1E/PI-27E		LF-4W/PI-1W		LF-4W/PI-13W		GENERAL	
				S[1]	M[2]	S	M	S	M	S	M	S	M	S	M	S	M
ACCESS ROADS	B. ENVIRONMENTAL IMPACTS																
	• Residents	• disruption of day-to-day activities and/or the use and enjoyment of property (adjacent)	• exhaust emissions from traffic	1	0	2	0	0	0	0	0	1	0	1	1		
			• access route passes through a residential area	6	3	5	3	0	0	0	0	0	1	0	1		
			• dust	0	0	0	0	1	0	1	0	1	0	1	0		
			• impact of noise from trucks	5	2	4	2	1	0	1	0	0	1	0	4		
			• impact of vibration from trucks	0	0	0	0	1	0	1	0	0	0	0	0		
		• disruption of day-to-day activities and/or the use and enjoyment of property (vicinity)	• exhaust emissions from traffic	1	0	2	0	0	0	0	0	1	0	1	1		
			• access route passes through a residential area	6	3	5	3	0	0	0	0	0	1	0	1		
			• dust	0	0	0	0	1	0	1	0	1	0	1	0		
			• impact of noise from trucks	5	2	4	2	1	0	1	0	0	1	0	4		
			• impact of vibration from trucks	0	0	0	0	1	0	1	0	0	0	0	0		
	• Community and Recreation Features	• disruption of operations of community and recreation features (adjacent)	-	-	-	-	-	-	-	-	-	-	-	-	-		
		• disruption of operations of community and recreation features (vicinity)	-	-	-	-	-	-	-	-	-	-	-	-	-		
	• Land Use	• existing land use	-	-	-	-	-	-	-	-	-	-	-	-	-		

TABLE C.8

Issues Raised in Site Selection by the Public and Agencies -
Relationship to Site Selection Factors and Frequency of Occurrence

STUDY AREA	FACTOR GROUPING	SITE SELECTION FACTORS	SITE SELECTION ISSUES	FREQUENCY OF OCCURRENCE													
				LF-3C		LF-9C		LF-1E		LF-1E/PI-27E		LF-4N/PI-1N		LF-4N/PI-13N		GENERAL	
				S[1]	M[2]	S	M	S	M	S	M	S	M	S	M	S	M
ACCESS ROADS (continued)	B. **ENVIRONMENTAL IMPACTS**																
	• **Land Use** (cont'd)	• planned and proposed land uses	• proximity to future land developments	0	1	0	1	0	0	0	0	3	3	3	3		
	• **Agricultural Resources**	• disruption to farm traffic and cattle crossings	• traffic conflict with farm vehicles	6	3	5	2	1	0	1	0	1	1	1	1	1	0
			• traffic conflict with animals on the highway	0	1	0	0	0	0	0	0	0	0	0	0		
		• disruption to crop and livestock production	-	-	-	-	-	-	-	-	-	-	-	-	-		
	• **Natural Environment**	• fish communities	-	-	-	-	-	-	-	-	-	-	-	-	-		

TABLE C.9

Issues Raised by Public and Agencies Relating to Mitigation/Compensation

Issue	Frequency													
	3C		9C		IE		1E/27E		4N/1N		4N/13N		General	
	S[1]	M[2]	S	M	S	M	S	M	S	M	S	M	S	M
° need for transportation regulations/ safeguards	0	4	0	3	0	1	0	1	7	5	8	5		
° need for driver training programs	0	1	0	1	0	2	0	2	0	0	0	0		
° need for transportation safety studies	2	1	1	1	0	1	0	1	0	1	0	1	1	0
° need for access route upgrading	5	9	3	9	0	3	0	3	2	7	2	7	1	0
° need to monitor emissions	0	0	0	0	1	1	1	1	0	2	0	2		
° need to monitor water supply	0	0	0	0	2	0	0	0	2	0	2	0		
° need for monitoring health/health studies	1	1	0	1	4	0	4	0	4	1	4	1		
° need for compensation program for future health problems	0	0	0	0	1	0	1	0	1	0	1	0		
° need for compensation to surrounding landowner due to devaluation	8	0	5	2	2	2	1	4	5	4	6	6	1	1
° need to ensure proper management of forested areas	2	2	1	2	0	0	1	0	2	0	2	0		

[1] S = Submission

[2] M = Meeting

TABLE C.9

Issues Raised by Public and Agencies Relating to Mitigation/Compensation

Issue	Frequency													
	3C		9C		IE		1E/27E		4N/1N		4N/13N		General	
	S[1]	M[2]	S	M	S	M	S	M	S	M	S	M	S	M
° concerns about facility operations	1	0	1	1	0	0	0	0	0	0	0	0	1	0
° need for plant emergency procedures	0	0	0	0	1	2	1	2	0	1	0	2		
° need for monitoring of the facility	0	0	0	0	0	1	0	1	0	0	0	0	0	1
° need for in-plant training program	0	0	0	0	0	0	0	0	0	0	0	0		
° compensation due to spill/accident explosion	1	0	0	0	1	1	1	1	0	1	0	1		
° increased insurance costs	0	0	0	0	1	0	1	0	0	0	0	0	1	0
° need for emergency service procedure to be developed	9	5	4	3	3	0	3	0	8	4	9	4	2	2
° need for establishment of a clean-up fund in case of spill/accident	0	0	0	0	3	0	3	0	1	0	1	0		

[1] S = Submission
[2] M = Meeting

TABLE C.10

General Issues Raised by the Public and Agencies but not Related to a Specific Factor

Issue	Frequency													
	3C		9C		IE		1E/27E		4N/1N		4N/13N		General	
	S[1]	M[2]	S	M	S	M	S	M	S	M	S	M	S	M
° increased truck traffic	18	0	15	1	7	3	7	3	5	1	7	2	1	0
° general concern with transportation	15	6	12	5	6	2	6	2	3	3	3	3	2	0
° long-term health and safety of residents	6	0	3	0	1	3	1	3	14	1	14	1		
° land use	0	0	0	0	0	1	0	1	0	0	0	0		

[1] S = Submission

[2] M = Meeting

Table C.11

Rationale for Major Risks or Impacts

LF-4N/PI-1N

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
A. **RISK**				
• **Transportation**	• annual province-wide hazard-based spill index of OWMC generated transport	8	-3.0	• relatively high factor suitability level; second highest spills index due to non-motor vehicle accidents (along with LF-4N/PI-13N) of all siting options • high factor rank
	• transportation risks on local and regional access roads due to accident involvements of OWMC generated transport	10	-1.1	• high factor rank
• **Air Quality**	• risk from direct inhalation of emissions - chronic	9	-4.1	• high factor suitability level; relatively high future population exposure - fugitive emissions, high relative population exposure - fugitive emissions, high relative future population exposure - incinerator stack emissions • high factor rank
	• risk from direct inhalation of emissions - acute	8	-5.0	• high factor suitability level; high level of topographic features on or around site high relative distribution of community facilities • high factor rank
	• risk from consumption of crops and livestock	5	-3.1	• high factor suitability level; high values for relative sensitive crop exposures - fugitive emissions and relative future sensitive crop exposures - fugitive emissions
• **Hydrogeologic Suitability**	• capability of providing natural containment	10	-6.0	• very high factor suitability level; confining layer is thin at both sites resulting in relatively rapid breakthrough times • high factor rank
	• ground water use	7	-5.0	• high factor suitability level; ground water supplies may be developed in granular aquifers, aquifer at LF-4N may be capable of meeting more demanding water use requirements
• **Surface Water Suitability**	• susceptibility of site to flooding	3	-3.0	• relatively high factor suitability level; LF-4N has designated floodplain land (Indian Creek) on-site

Table C.11

Rationale for Major Risks or Impacts

LF-4N/PI-1N

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
B. ENVIRONMENTAL IMPACTS				
• Site				
- Residents	• displacement of residents	9	-3.1	• relatively high factor suitability level; third highest number of residents displaced (34) • high factor rank
- Community and Recreation Features	• displacement of historical, community and recreation features	3	-5.0	• high factor suitability level; 2 significant features displaced, two historic buildings - one is the Tomasky house and the other is designated under the Ontario Heritage Act
- Land Use	• planned and proposed land use	7	-4.7	• high factor suitability level; generally agricultural land use designations which are partially offset by sanitary landfill designation on LF-4N, policies and zoning are protective of agricultural land
	• land use stability	2	-3.0	• relatively high factor suitability level; relatively high proportion of lands under absentee ownership but no land sales, high proportion of good quality buildings
- Agricultural Resources	• loss of farmland	6	-5.0	• high factor suitability rating; Class 1 equivalent rating on-site is high (264 ha), most impacted siting option in terms of loss of farmland
- Natural Environment	• rare species	8	-3.0	• relatively high factor suitability level; moderate potential impact on rare plant species • high factor rank
	• natural vegetation displaced	4	-1.0	• public concern
	• potential for occurrence of other significant features	6	-1.0	• public concern

Table C.11

Rationale for Major Risks or Impacts

LF-4N/PI-1N

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
B. ENVIRONMENTAL IMPACTS (cont'd)				
• Site Vicinity				
- Residents	• property value impacts	7	-3.9	• relatively high factor suitability level; moderately high degree of negative property value impacts ($1,487,000) within site vicinity
	• disruption of use and enjoyment of property and/or day-to-day activities (adjacent to site)	10	-4.3	• high factor suitability level; second most impacted siting option, 88 residents adjacent to site and 23 residents spending most time on properties adjacent to site • high factor rank
	• disruption of use and enjoyment of property and/or day-to-day activities (non-adjacent)	9	-5.0	• high factor suitability level; most impacted siting option in terms of disruption of daily activities of residents in site vicinity, has the most residents in site vicinity, has the most residents in nighttime noise zone (15) and second most in daytime noise zone (55), second most impacted in terms of visual intrusion • high factor rank
- Community and Recreation Features	• disruption of operations of community and recreation features (adjacent to site)	5	-2.5	• public concern
	• disruption of operations of community and recreation features (site vicinity)	3	-2.7	• public concern
- Land Use	• existing land use	8	-3.3	• relatively high factor suitability level; conflict with existing land use - basic agricultural conflict • high factor rank
	• planned and proposed land use	7	-5.0	• high factor suitability level; primarily designated agricultural with some significant residential clusters, no industrial lands, official plan policies are protective of agricultural lands and permit some residential infilling, conflict with future land use - basic agricultural conflict

Table C.11

Rationale for Major Risks or Impacts

LF-4N/PI-1N

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
B. ENVIRONMENTAL IMPACTS (cont'd)				
- Land Use (cont'd)	• provincial policies and plans	2	-5.0	• high factor suitability level; siting option may impact both Parkway Belt West Plan and Niagara Escarpment Plan
- Agricultural Resources	• partial displacement of farms	9	-4.4	• high factor suitability level; number of farms with headquarters losing on-site land is high (5) • high factor rank
	• disruption of adjacent farm operations	10	-3.4	• relatively high factor suitability level; moderately high number of headquartered farms (5) and operators with owned land (8) • high factor rank
	• disruption of non-adjacent farm operations	9	-3.2	• relatively high factor suitability level; moderate number of farm operations with headquarters (16) and moderate livestock density • high factor rank
- Natural Environment	• rare species	2	-3.0	• relatively high factor suitability level; moderate potential impact in rare plant species
	• significant environment units (SEUs)	4	-1.0	• public concern
	• fish and wildlife features of significance	2	-1.0	• public concern
	• other natural vegetation	3	-1.0	• public concern
- Air Dispersion/ Air Quality	• restraints to dispersion	2	-5.0	• high factor suitability level; high impact due to local modifications to dispersion climatology, some potential for wind channelling and effects on atmospheric turbulence

Table C.11

Rationale for Major Risks or Impacts

LF-4N/PI-1N

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
B. **ENVIRONMENTAL IMPACTS** (cont'd)				
- Air Dispersion/ Air Quality (cont'd)	• existing and anticipated air quality	6	-3.3	• relatively high factor suitability level; high values for estimated effect on air quality for both incinerator stack emissions and fugitive emissions; however, incremental effects expected to be minimal
• **Community and Regional**				
- Community and Regional	• social stability	8	-3.4	• relatively high factor suitability level; second lowest level of existing stability, however, potentially least impacted siting option in terms of overall social stability • high factor rank
	• community character	8	-4.8	• high factor suitability level; second most impacted siting option with respect to compatibility with existing land use, heritage features and visual compatibility, predominantly rural/agricultural area • high factor rank
	• community and regional economic base	8	+2.6	• high factor rank
- Land Use	• existing land use	4	-5.0	• high factor suitability level; primarily agricultural land use pattern with some significant residential areas but no compatible industrial lands, conflict with existing land use - proximity to urban development in Milton area
	• planned and proposed land use	4	-5.0	• high factor suitability level; predominantly agricultural land use designations with some residential clusters but no industrial lands, official plan policies protect agricultural lands, conflict with future land use - proximity to urban development in Milton area
	• provincial plans and policies	1	-5.0	• high factor suitability level; siting option may impact both Parkway Belt West Plan and Niagara Escarpment Plan

Table C.11

Rationale for Major Risks or Impacts

LF-4N/PI-1N

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
B. **ENVIRONMENTAL IMPACTS** (cont'd)				
- Agricultural Resources	• stability of farm population	9	-4.4	• high factor suitability level; moderately high proportion of farmers under the age o 55 as well as proportion of full-time operators • high factor rank
	• stability of agricultural land base	8	-4.1	• high factor suitability level; large percentage of land in large parcels, high amour of Class 1 equivalents, high amount of private land ownership • high factor rank
	• disruption to farm economy	8	-3.5	• relatively high factor suitability level; gross farm revenue is moderately low, fugitive and stack exposure to livestock indices are high • high factor rank
• Access Roads				
- Residents	• disruption of day-to-day activities and/or the use and enjoyment of property (adjacent)	8	-2.1	• high factor rank
- Community and Recreation Features	• disruption of operation of community and recreation features (adjacent)	2	-4.1	• high factor suitability level; second highest number of features (16) (along with LF-4N/PI-1N) and second highest number of sensitive features (7) (along with LF-4N/PI-1N) adjacent to access route
	• disruption of operations of community and recreation features (vicinity)	1	-4.6	• high factor suitability level; third highest number of features (12) and sensitive features (5) in access road vicinity
- Land Use	• existing land use	4	-3.3	• relatively high factor suitability level; moderate number of residences and commercial facilities and a high proportion of residential land use along access route

Table C.11

Rationale for Major Risks or Impacts

LF-4N/PI-1N

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
B. **ENVIRONMENTAL IMPACTS** (cont'd)				
- Land Use (cont'd)	• planned and proposed land use	4	-4.9	• high factor suitability level; access route travels through rural/agricultural areas with substantial amounts of residentially designated land, policies protect agricultural lands, major urban development proposal along access route
- Agricultural Resources	• disruption to farm traffic and cattle crossings	8	-3.0	• relatively high factor suitability level; moderately high agricultural vehicle impact index along local roads • high factor rank
- Natural Environment	• fish communities	4	-5.0	• high factor suitability level; high fishery constraint for regionally significant fishery

Table C.12

Rationale for Major Risks or Impacts

LF-4N/PI-13N

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
A. **Risk**				
• **Transportation**	• annual province-wide hazard-based spill index of OWMC generated transport	8	-3.0	• relatively high factor rank and factor suitability level • the province-wide system risk is equal for siting options within the same geographic area (i.e. LF-4N/PI-1N and LF-4N/PI-13N) • statistically significant difference between risks for northern sites and either central or eastern sites (lowest risk for province-wide system for accident-related spills for northern sites) • non-accident-related spills similar for West Lincoln and Milton sites
	• transportation risks on local and regional access roads due to accident involvements of OWMC generated transport	10	-1.0	• high factor rank
• **Air Quality**	• risks from direct inhalation of emissions - chronic	9	-4.8	• high factor rank and suitability level • factor suitability level reflects; relatively high population surrounding siting option; highest population exposure to incinerator stack emissions, but lower exposure to fugitive emissions than worst option (LF-1E/PI-27E)
	• risks from direct inhalation of emissions - acute	8	-5.0	• high factor rank and factor suitability level • factor suitability level reflects; highest relative future and existing population exposure to low elevation sources and high constraint in terms of topographic features • small distinction between worst ranked site LF-4N/PI-1N and LF-4N/PI-13N

Table C.12

Rationale for Major Risks or Impacts

LF-4N/PI-13N

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
A. Risk (cont'd)				
• Air Quality (cont'd)	• risks from consumption of crops and livestock	5	-3.2	• relatively high factor rank and factor suitability level • factor suitability level reflects highest sensitive crop exposures for both existing and future crops - fugitive emissions; other indices are low or moderate
• Hydrogeologic Suitability	• capability to provide natural containment	10	-6.0	• absolute constraint and high factor rank and suitability level • not considered basically acceptable with regard to natural containment • confining layer at PI-13N is discontinuous as a result of erosion and rapid breakthrough times are predicted for both sites
	• ground water use	7	-5.0	• high factor rank and suitability level • high factor suitability level reflects absence of suitable alternative ground water supply in the vicinity of PI-13N and potential for expanded use of water for aquifer at LF-4N
• Surface Water Suitability	• susceptibility of site to flooding	3	-3.0	• relatively high factor suitability level; middle level of relative constraint due to proximity of significant floodplain of Indian Creek in the south-west and north-west of site LF-4N (designated floodplain)
	• potential for surface water use interference	7	-5.0	• high factor suitability level • highest relative level of constraint due to location of potable uses immediately downstream from site PI-13N and high downstream water use index

Table C.12

Rationale for Major Risks or Impacts

LF-4N/PI-13N

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
B. Environmental Impacts				
• Site				
- Residents	• displacement of residents	9	-3.1	• relatively high factor rank and suitability level; fourth highest number of residents on-site (31)
- Community and Recreation Features	• displacement of historical, community and recreation features	3	-4.0	• high factor suitability level; 2 features displaced, one of which is significant (historic building and proposed Glenorchy Conservation Area)
- Land Use	• proposed and planned land use	7	-4.3	• high factor suitability level • has generally agricultural land use designations (high constraint) which are partially offset by the sanitary landfill designation on LF-4N which may accommodate the landfill facility
- Agricultural Resources	• displacement of farms with on-site	6	-5.0	• high factor suitability level • high factor suitability level reflects high rented farm size and estimated gross farm revenue
	• loss of farmland	6	-4.9	• high factor suitability level • Class 1 equivalent rating is high; no tile drainage
- Natural Environment	• rare species	8	-3.0	• relatively high factor rank and suitability level • suitability level reflects medium potential impact on both rare plant and animal species
	• natural vegetation displaced	4	-1.0	• public issue; 59 ha displaced, the second lowest of all siting options
	• potential for occurrence of other significant natural features	6	-1.0	• public issue, low potential for occurrence

Table C.12

Rationale for Major Risks or Impacts

LF-4N/PI-13N

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
B. Environmental Impacts (cont'd)				
• Site Vicinity				
- Residents	• property value impacts	7	-5.0	• high factor suitability level reflecting high degree of negative property value impacts ($1,972,000) due to higher proportion of residential and commercial uses in area
	• disruption of use and enjoyment of property and/or day-to-day activities (adjacent)	10	-5.0	• high factor rank and suitability level • high suitability level reflects greatest number of residents living adjacent and home during the day
	• disruption of use and enjoyment of property and/or day-to-day activities (non-adjacent)	9	-5.0	• high factor rank and suitability level; most potentially impacted in terms of visual intrusion; largest number of residents in the site vicinity
- Businesses	• business activities negatively affected by the presence of OWMC facilities	6	-5.0	• high factor suitability level reflecting high number of businesses (16), annual sales ($4,318,000) and number of employees (129)
- Community and Recreation Features	• disruption of operations of community and recreation features (adjacent to site)	5	-5.0	• high factor suitability level for LF-4N and PI-13N; 2 features adjacent to site (Spirit of Movement Club and proposed Glenorchy Conservation Area) and no sensitive features
	• disruption of operations of community and recreation features (non-adjacent)	3	-2.8	• public concern; one feature within noise impact zone, seven sensitive and 16 features within site vicinity
- Land Use	• existing land use	8	-5.0	• high factor rank and suitability level reflecting greatest number of residences within 1000 m and the site vicinity and greatest number of commercial facilities
	• proposed and planned land use	7	-5.0	• high factor suitability level reflects basic incompatibility with primarily agriculturally designated land with some significant residential clusters and no industrial lands

Table C.12

Rationale for Major Risks or Impacts

LF-4N/PI-13N

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
B. Environmental Impacts (cont'd)				
- Land Use (cont'd)	• provincial policies and plans	2	-3.3	• relatively high suitability level reflects that siting option vicinity is within Niagara Escarpment and Parkway Belt West planning area - no major conflict
- Agricultural Resources	• partial displacement of farms (off-site farms with on-site land)	9	-3.0	• relatively high factor rank and suitability level reflecting one off-site farm losing rented on-site land, but average parcel size last is high (79 ha)
	• disruption of adjacent farm operations	10	-5.0	• high factor rank and suitability level • factor suitability level reflects high number of farms with headquarters (8) and number of operators with owned land (11); moderate livestock density
	• disruption of non-adjacent vicinity farm operations	9	-3.3	• high factor rank and relatively high factor suitability level • suitability level reflects 19 vicinity operations having 66% in crops and moderately-low livestock density
- Natural Environment	• other natural vegetation	3	-3.0	• relatively high factor suitability level • 291 ha of other natural vegetation
	• rare species	2	-5.0	• high factor suitability level; high potential impact on rare plant species (7 species)
	• SEUs	4	-1.0	• public concern • 94 ha of SEU
	• fish and wildlife features of significance	2	-1.0	• public concern • one waterfowl staging area
- Air Dispersion/ Air Quality	• restraints to dispersion	2	-3.0	• relatively high factor suitability level and public concern regarding Niagara Escarpment; minor wind channelling possible due to break in Niagara Escarpment

Table C.12

Rationale for Major Risks or Impacts

LF-4N/PI-13N

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
B. Environmental Impacts (cont'd)				
- Air Dispersion/ Air Quality (cont'd)	• existing and anticipated air quality	6	-3.4	• relatively high factor suitability level reflects good existing air quality characteristics and, therefore, relatively high effect on air quality
• Community and Regional				
- Community and Regional	• social stability	8	-3.4	• high factor rank and relatively high factor suitability level • suitability level reflects lowest existing level of social stability; a moderate level of potential disruption through resident displacement; second most potentially disrupted through voluntary out-migration • Milton has undergone considerable change over the past years and more change is expected
	• social cohesion	6	-3.4	• relatively high factor suitability level • suitability level reflects most impact for resident displacement and third most impact in terms of resident out-migration • Milton expected to adjust easily to change; households expected to replace those that move out (IER, 1985a, p.306)
	• community character	8	-5.0	• high factor rank and suitability level • highest factor suitability level reflects most impact with respect to heritage features; most impact with respect to visual compatibility; and second most impact in terms of compatibility with land use • this high level of impact may be tempered by diversity and change for Milton sites which reduce the effect of the facility on broad community character
	• regional and community economic base	8	+2.6	• high factor rank

Table C.12

Rationale for Major Risks or Impacts

LF-4N/PI-13N

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
B. **Environmental Impacts** (cont'd)				
- **Land Use**	• existing land use	4	-5.0	• high factor suitability level reflects basic incompatibility with primarily agricultural land use patterns and some significant residential areas in region, and no compatible industrial lands
	• proposed and planned land use	4	-5.0	• high factor suitability level reflects basic incompatibility with predominantly agricultural land use designations with some residential clusters, and no industrial lands
	• provincial policies and plans	1	-3.8	• relatively high factor suitability level reflects that siting option community and region is within Parkway Belt West and Niagara Escarpment planning areas - no major conflict
- **Agricultural Resources**	• stability of farm population	9	-4.0	• high factor rank and suitability level reflects instability due to moderate proportion of young (potentially more vulnerable) operators and moderately high proportion of full-time operators
	• stability of agricultural land base	8	-3.7	• high factor rank and relatively high factor suitability level reflecting stable agricultural characteristics; high amount of land in large parcels and high Class 1 equivalent rating, but lowest land in private ownership and moderately-low amount of area is owned
	• disruption to the farm economy	8	-5.0	• high factor rank and suitability level reflecting potentially high disruption; gross farm revenue in the region is high ($16.3 million, 1981); stack emissions indices for livestock are high; fugitive emissions indices for livestock and stack emissions for crops are moderate
• **Access Roads**				
- **Residents**	• disruption of day-to-day activities and/or the use and enjoyment of property (adjacent)	8	-1.9	• high factor rank • 481 adjacent residents, the third highest of all siting options
	• disruption of day-to-day activities and/or the use and enjoyment of property (non-adjacent)	7	-1.3	• public concern • third highest number of residents (370) within noise impact zone and third highest number of residents (347) in access road vicinity

Table C.12

Rationale for Major Risks or Impacts

LF-4N/PI-13N

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
B. Environmental Impacts (cont'd)				
- Community and Recreation Features	• disruption of operations of community and recreation features (adjacent)	2	-4.1	• high factor suitability level • second highest number of adjacent features (16) and sensitive features (7)
	• disruption of operations of community and recreation features (vicinity)	1	-5.0	• high factor suitability level • has the largest number of features and the largest number of sensitive features in the vicinity; the number of sensitive features and total features within the noise impact zone are ranked first and second, respectively, relative to the other siting options
- Land Use	• existing land use	4	-3.3	• relatively high factor suitability level reflecting incompatibility with non-industrial land uses
	• planned and proposed land use	4	-4.9	• high factor suitability level reflecting that route travels through rural/agricultural area with substantial amounts of agriculturally designated land; policies protect agricultural land; high proportion of unapproved development proposals
- Agricultural Resources	• disruption to farm traffic and cattle crossings	8	-4.3	• high factor rank and suitability level • suitability level reflects high agricultural use on local roads and moderate use on regional roads; there are cattle crossings on the local roads
- Natural Environment	• fish communities	4	-5.0	• high factor suitability level; high fishery constraint for regionally significant fishery

TABLE C.13

Major Risk Differences

LF-4N/PI-1N vs. LF-4N/PI-13N

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-4N/PI-1N	LF-4N/PI-13N	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
A. RISK				
• Transportation				
• annual province-wide hazard-based index of OWMC generated transport	8	-3.0	-3.0	• no difference between options; difference screened
• transportation risks on local and regional access roads due to accident involvements of OWMC generated transport	10	-1.1	-1.0	• minor difference in accident rates; every 1.1 years for LF-4N/PI-1N; 1 every 0.9 years for LF-4N/PI-13N; difference screened
• transportation risks on local and regional access roads due to hazard-based spills of OWMC generated transport	10	0.9	-0.7	• minor difference between options; 1 spill every 34.4 years for LF-4N/PI-1N; 1 spill every 40.8 years for LF-4N/PI-13N; difference screened
• Air Quality				
• risk from direct inhalation of emissions - chronic	9	-4.1	-4.8	• relative existing population exposure to fugitive emissions is lower for LF-4N/PI-13N, but all other indices higher • differences between options minor, but factor highly ranked; therefore, differences considered significant
• risk from direct inhalation of emissions - acute	8	-5.0	-5.0	• no difference between options; difference screened
• risks from consumption of crops and livestock	5	-3.1	-3.2	• minor differences between crop and livestock exposures; differences screened

TABLE C.13

Major Risk Differences

LF-4N/PI-1N vs. LF-4N/PI-13N

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-4N/PI-1N	LF-4N/PI-13N	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
A. **RISK** (Cont'd)				
• **Hydrogeologic Suitability**				
• capability to provide natural containment	10	-5.0	-6.0	• LF-4N/PI-13N not considered basically acceptable because confining layer of PI-13N is discontinuous as a result of erosion; confining layer is then at both LF-4N and PI-1N resulting in rapid breakthrough times • differences considered sufficient to warrant inclusion
• ground water use	7	-5.0	-5.0	• no difference between options; difference screened
• **Surface Water Suitability**				
• susceptability of site to flooding	3	-3.0	-3.0	• no difference between options; difference screened
• potential for surface water use interference	7	-3.0	-5.0	• downstream water use index 36 and no local stream takings for LF-4N/PI-1N; downstream water use index is 40 and 2 local stream takings for potable supply for LF-4N/PI-13N • differences considered sufficient to warrant inclusion

TABLE C.14

Major Impact Differences

LF-4N/PI-1N vs. LF-4N/PI-13N

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-4N/PI-1N	LF-4N/PI-13N	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
B. **ENVIRONMENTAL IMPACTS**				
• **Site**				
• **Residents**				
• displacement of residents	9	-3.1	-3.1	• no difference between options; difference screened
• **Community and Recreation Features**				
• displacement of historical, community and recreation features	3	-5.0	-4.0	• for LF-4N/PI-1N, 2 significant features displaced; for LF-4N/PI-13N, 2 features of which one is significant are displaced • difference considered sufficient to warrant inclusion
• **Land Use**				
• planned and proposed land use	7	-4.7	-4.3	• higher proportion agricultural land use designations for PI-13N (95% versus 78%); PI-1N has 22% conservation and hazard lands (versus 5%) and 9 vacant lots of record (versus 3) • difference not considered sufficient to warrant inclusion
• land use stability	2	-3.0	-2.1	• higher absentee land ownership for LF-4N/PI-13N (86% area versus 66%) and lower good quality building (67% versus 82%) • difference is considered minor and therefore screened
• **Agricultural Resources**				
• displacement of farms with on-site headquarters	6	-2.3	-5.0	• more farm operations rented for LF-4N/PI-13N (2 versus 0 with 101 ha average size) and gross farm revenue higher ($177,300 versus $77,000) • differences considered sufficient to warrant inclusion
• loss of farmland	6	-5.0	-4.9	• slightly higher soil capability (Class 1 equivalent) for LF-4N/PI-1N (264 ha versus 261 ha) • differences minor; differences screened

TABLE C.14

Major Impact Differences

LF-4N/PI-1N vs. LF-4N/PI-13N

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-4N/PI-1N	LF-4N/PI-13N	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
B. **ENVIRONMENTAL IMPACTS** (Cont'd)				
• Natural Environment				
• rare species	8	-3.0	-3.0	• no difference between options; difference screened
• natural vegetation displaced	4	-1.0	-1.0	• no differences between options; difference screened
• potential for occurence of other significant natural features	6	-1.0	-1.0	• no difference between options; difference screened
• Site Vicinity				
• Residents				
• property value impacts	7	-3.9	-5.0	• for LF-4N/PI-1N potential for negative change in property value is $1,487,000; for LF-4N/PI-13N potential for negative property value change is $1,912,000 • difference considered sufficient for inclusion
• disruption of use and enjoyment of property and/or day-to-day activities (adjacent to site)	10	-4.3	-5.0	• LF-4N/PI-1N has 23 residents adjacent and spending most of time on property and 88 adjacent residents; LF-4N/PI-13N has 28 residents adjacent and spending most of time on property and 95 residents adjacent • differences not considered of large magnitude, but factor rank high; therefore, differences considered sufficient for inclusion
• disruption of use and enjoyment of property and/or day-to-day activities (non-adjacent)	9	-5.0	-5.0	• no difference between options; difference screened

TABLE C.14

Major Impact Differences

LF-4N/PI-1N vs. LF-4N/PI-13N

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-4N/PI-1N	LF-4N/PI-13N	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
B. ENVIRONMENTAL IMPACTS (Cont'd)				
• Businesses				
• business activities negatively affected by the presence of OWMC facilities	6	-2.6	-5.0	• for LF-4N/PI-1N, 14 businesses negatively affected, representing 39 employees and $1,473,000 in annual sales; for LF-4N/PI-1N, 16 businesses negatively affected, representing 91 employees and $4,318,000 in annual sales • differences considered sufficient to warrant inclusion
• Community and Recreation Features				
• disruption of operations of community and recreation features (adjacent to site)	5	-2.5	-5.0	• 1 more feature adjacent to LF-4N/PI-13N (Hunterbrook Farms for LF-4N/PI-1N versus Spirit of Movement Club and Proposed Glenorchy Conservation Area for LF-4N/PI-13N) • difference considered sufficient to warrant inclusion
• disruption of operations of community and recreation features (site vicinity)	3	-2.7	-2.8	• 1 more sensitive feature for LF-4N/PI-13N • difference minor and therefore screened
• Land Use				
• existing land use	8	-3.3	-5.0	• for LF-4N/PI-13N major conflict with existing land use - highest number of residences in site vicinity; for LF-4N/PI-1N basic agricultural conflict • differences considered sufficient to warrant inclusion
• proposed and planned land use	7	-5.0	-5.0	• no difference between options; difference screened
• provincial policies and plans	2	-5.0	-3.3	• PI-13N is not affected by the Niagara Escarpment Plan and has low conflict with the Parkway Belt West Plan; PI-1N has moderate conflict with both plans • difference considered sufficient for inclusion

TABLE C.14

Major Impact Differences

LF-4N/PI-1N vs. LF-4N/PI-13N

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-4N/PI-1N	LF-4N/PI-13N	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
B. ENVIRONMENTAL IMPACTS (Cont'd)				
• Agricultural Resources				
• partial displacement of farms	9	-4.4	-3.0	• for LF-4N/PI-1N 5 farms with headquarters are affected and average parcel size is 50 ha; for LF-4N/PI-13N 1 farm with headquarters affected and average parcel size is 79 ha • difference considered minor, but factor highly ranked; therefore, difference warrants inclusion
• disruption of adjacent farm operations	10	-3.4	-5.0	• for LF-4N/PI-1N 5 farms displaced with 8 operators with owned land and 0.40 livestock density (animal units/ha); for LF-4N/PI-13N 8 farms with headquarters, 11 operators with owned land and 0.54 livestock density (animal units/ha) • difference considered sufficient to warrant inclusion
• disruption of non-adjacent vicinity farm operations	9	-3.2	-3.3	• slightly greater disruption for LF-4N/PI-13N (16 versus 19 farms with headquarters) • difference not considered sufficient to warrant inclusion
• Natural Environment				
• other natural vegetation	3	-1.0	-3.0	• approximately 245 ha of other natural vegetation for LF-4N/PI-1N and 291 ha for LF-4N/PI-13N • difference considered sufficient to warrant inclusion
• rare species	2	-3.0	-5.0	• 8 rare plant species and 3 rare animal species for LF-4N/PI-1N and 7 rare plant species and 6 rare animal species for LF-4N/PI-13N • difference considered sufficient to warrant inclusion
• Air Dispersion/Air Quality				
• restraints to dispersion	2	-5.0	-3.0	• wind channelling caused by break in escarpment between Rattlesnake Point and Mt. Nemo will be less for PI-13N than for PI-1N • difference considered sufficient for inclusion

TABLE C.14

Major Impact Differences

LF-4N/PI-1N vs. LF-4N/PI-13N

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-4N/PI-1N	LF-4N/PI-13N	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
B. **ENVIRONMENTAL IMPACTS** (Cont'd)				
• existing and anticipated air quality	6	-3.3	-3.4	• slightly higher constraint for existing air quality for LF-4N/PI-13N • difference not considered sufficient for inclusion
• Community and Regional				
• Community and Regional				
• social stability	8	-3.4	-3.4	• no difference between options; difference screened
• SEUs	4	-1.0	-1.0	• no difference between options; difference screened
• fish and wildlife features of significance	2	-1.0	-1.0	• no difference between options; difference screened
• social cohesion	6	-2.2	-3.4	• LF-4N/PI-1N potential for disruption through resident displacement and voluntary out-migration is second lowest and lowest, respectively; LF-4N/PI-13N is most impacted for resident displacement and third most impacted in terms of resident out-migration • difference considered sufficient for inclusion
• community character	8	-4.8	-5.0	• visual and heritage features impact less for LF-4N/PI-1N • slightly higher impact for LF-4N/PI-13N and high factor rank; therefore, difference considered sufficient for inclusion
• regional and community economic base	8	+2.6	+2.6	• no difference between options; difference screened
• Land Use				
• existing land use	4	-5.0	-5.0	• no difference between options; difference screened

TABLE C.14

Major Impact Differences

LF-4N/PI-1N vs. LF-4N/PI-13N

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-4N/PI-1N	LF-4N/PI-13N	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
B. **ENVIRONMENTAL IMPACTS** (Cont'd)				
• **Land Use**				
• proposed and planned land use	4	-5.0	-5.0	• no difference between options; difference screened
• provincial policies and plans	1	-5.0	-3.8	• PI-13N not affected by Niagara Escarpment Plan; PI-1N affected by both Niagara Escarpment and Parkway Belt West Plans • difference considered sufficient to warrant inclusion
• **Agricultural Resources**				
• stability of farm population	9	-4.4	-4.0	• for LF-4N/PI-1N 62% of farmers are under 55 years of age and 56% are full-time operators; for LF-4N/PI-13N 58% of operators are under 55 years of age and 49% are full-time operators • differences minor, but high factor rank; therefore, difference included
• stability of agricultural land base	8	-4.1	-3.7	• minor differences in land tenure, proportion of farm residences agricultural designations and private land ownership • difference minor, but high factor rank; therefore, difference included
• disruption to farm economy	8	-3.5	-5.0	• gross farm revenue for LF-4N/PI-1N is $6.4 million (1981), livestock index is 1.19 and crop index is 0.21; for LF-4N/PI-13N gross farm revenue is $16.3 million (1981), livestock index is 3.94 and crop index is 0.47 • difference sufficient to warrant inclusion
• **Access Roads**				
• **Residents**				
• disruption of day-to-day activities and/or the use and enjoyment of property (adjacent)	8	-2.1	-1.9	• 481 residents adjacent to access routes for LF-4N/PI-13N, but less sensitive characteristics of residents than LF-4N/PI-1N; LF-4N/PI-1N has 435 adjacent residents • minor difference between options, but high factor rank; therefore, difference included

TABLE C.14

Major Impact Differences

LF-4N/PI-1N vs. LF-4N/PI-13N

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-4N/PI-1N	LF-4N/PI-13N	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
B. **ENVIRONMENTAL IMPACTS** (Cont'd)				
• **Residents**				
• disruption of day-to-day activities and/or the use and enjoyment of property (non-adjacent)	7	-1.2	-1.3	• slightly higher number of residents within site vicinity and noise zone for LF-4N/PI-13N • differences considered minor and therefore screened
• **Community and Recreation Features**				
• disruption of operations of community and recreation features (adjacent)	2	-4.1	-4.1	• no difference between options; difference screened
• disruption of operations of community and recreation features (vicinity)	1	-4.6	-5.0	• for LF-4N/PI-1N 5 sensitive features within access road vicinity and 12 features within access road vicinity; for LF-4N/PI-13N 7 sensitive features within access road vicinity and 15 features within access road vicinity • difference not considered sufficient for inclusion
• **Land Use**				
• existing land use	4	-3.3	-3.3	• no difference between options; difference screened
• planned and proposed land use	4	-4.9	-4.9	• no difference between options; difference screened
• **Agricultural Resources**				
• disruption to farm traffic and cattle crossings	8	-3.0	-4.3	• for LF-4N/PI-1N agricultural vehicle impact index is 10,000 and 5,500 customer/service vehicle stops; for LF-4N/PI-13N agricultural vehicle impact index is 12,150 and 12,050 customer/service vehicle stops • differences considered sufficient to warrant inclusion

TABLE C.14

Major Impact Differences

LF-4N/PI-1N vs. LF-4N/PI-13N

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-4N/PI-1N	LF-4N/PI-13N	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
B. **ENVIRONMENTAL IMPACTS** (Cont'd)				
• **Natural Environment**				
• fish communities	4	-5.0	-5.0	• no difference between options; difference screened

TABLE C.15

Rationale for Major Risks or Impacts

LF-3C

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
A. **Risk**				
• **Transportation**	• annual province-wide hazard-based spill index of OWMC generated transport	8	-3.3	• relatively high factor suitability level; moderate annual non-accident related spills (1 every 7.3 years) and annual accident related spills (1 every 17.3 years) relative to other siting options • high factor rank • the province-wide system risk is equal for siting options within the same geographic area (i.e. LF-9C and LF-3C)
	• annual province-wide accident involvements of OWMC generated transport	8	-3.2	• relatively high factor suitability level; moderate annual accident involvement (1.4 per year) • high factor rank • the province-wide system risk is equal for siting options within the same geographic area (i.e. LF-9C and LF-3C)
	• transportation risks on local and regional access roads due to accident involvements of OWMC generated transport	10	-5.0	• high factor suitability level; highest risk to road users of all siting options (1 accident every 0.8 years) • highest factor rank
	• transportation risks on local and regional access roads due to hazard-based spills of OWMC generated transport	10	-5.0	• relatively high suitability level; highest risk to all receptors except hydrogeologic sensitive lands • highest factor rank • major public concern regarding R.R. 24
• **Air Quality**	• risks from direct inhalation of emissions - chronic	9	-1.1*	• high factor rank
	• risks from direct inhalation of emissions - acute	8	-2.6	• high factor rank

* ORF - factor suitability levels converted to scale relative to highest option value by M.M. Dillon Ltd.

TABLE C.15

Rationale for Major Risks or Impacts

LF-3C

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
A. **Risk** (cont'd)				
• **Air Quality** (cont'd)	• risks from ingestion of cistern and pond water	6	-2.3	• this factor is a public concern • exposure from cistern and pond water is higher than for all options except LF-1E
	• risks from consumption of crops and livestock	5	-5.0	• high factor suitability level; the two West Lincoln options have higher risk values for all indicators, except sensitive existing and future crop exposures to fugitive emissions, than the other siting options
• **Hydrogeologic Suitability**	• capability to provide natural containment	10	-1.0	• highest factor rank
	• ground water use	7	-1.0	• risk of contamination of ground water is a public concern • water supplies completed in Salina Formation experience quality related problems; underlying aquifer is used mainly for domestic and agricultural purposes and is not expected to be capable of meeting more demanding water use requirements
• **Surface Water Suitability**	• susceptibility of site to flooding	3	-5.0	• high factor suitability level • highest flooding constraint for Beaver Creek and Welland River floodplains will require reliance on engineering measures to mitigate; significantly more constrained than other options although mitigation is possible
	• potential for water use interference	7	-2.5	• relatively high factor suitability level • no potable uses immediately downstream

TABLE C.15

Rationale for Major Risks or Impacts

LF-3C

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
B. Impacts				
• Site				
- Residents	• displacement of residents	9	-2.6	• high factor rank
- Land Use	• proposed and planned land use	7	-5.0	• high factor suitability level; basic incompatibility with agricultural land use designations
	• land use stability	2	-5.0	• high factor suitability level; highest level of stability of all siting options • factor considered supplementary to other more direct measures of social change
- Agricultural Resources	• displacement of farms with on-site headquarters	6	-4.9	• high factor suitability level; small number of headquarters (2) compared to other options but gross farm revenue is high
	• loss of farmland	6	-3.8	• relatively high factor suitability level; all sites have relatively low absolute loss of farmland • one of two sites with tile drainage on-site; moderately low Class 1 equivalent rating
- Natural Environment	• natural vegetation displaced	4	-3.0	• relatively high factor suitability level; two woodlots occur in the central and eastern portions of the site (15% of site area) and natural vegetation occurs along Beaver Creek
	• potential for occurrence of other significant features	6	-3.0	• relatively high factor suitability level; habitat is varied on-site which may indicate potential for occurrence of more rare species (e.g. thicket, marsh, old field and woodlot)

TABLE C.15

Rationale for Major Risks or Impacts

LF-3C

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
B. Impacts (cont'd)				
• Site Vicinity				
- Residents	• disruption of use and enjoyment of property and/or day-to-day activities (adjacent to site)	10	-3.4	• relatively high suitability level; 48 adjacent residents (versus 95 at most impacted option LF-4N/PI-13N) of which 23 spend most time on properties (versus 28 at LF-4N/PI-13N) • high factor rank
	• disruption of use and enjoyment of property and/or day-to-day activities (non-adjacent)	9	-2.8	• high factor rank
	• property value imapcts	7	-1.2	• public concern • low level of property value impacts (second lowest)
- Businesses	• business activities negatively affected by the presence of OWMC facilities	6	-3.1	• relatively high factor suitability level; negative impacts include those for Robert Land Military Academy (42 employees and $1.1 million annual budget) • nine businesses in total affected
- Community and Recreation Features	• disruption of operations of community and recreation features (site vicinity)	3	-5.0	• high factor suitability level and disruption of conservation park, and school are a public concern • although the total number of features is low, 2 are located in the noise impact zone and sensitive to noise (Elcho United Church and Cemetery)
	• disruption of operations of community and recreation features (adjacent)	5	-	• public concern • no features adjacent
- Land Use	• existing land use	8	-2.1	• high factor rank
	• proposed and planned land use	7	-4.5	• relatively high factor suitability level; basic conflict with agricultural land use designations

TABLE C.15

Rationale for Major Risks or Impacts

LF-3C

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
B. Impacts (cont'd)				
- Land Use (cont')	• land use stability	3	-5.0	• high factor suitability level; overall high level of stability • factor considered supplementary to other more direct measures of social change
- Agricultural Resources	• partial displacement of farms	9	-5.0	• high suitability level; rented land base lost is high; other indicators are moderate • high factor rank
	• disruption of adjacent farm operations	10	-3.7	• relatively high factor suitability level; moderately high number of farms with headquarters, moderately low livestock density; proportion of land and crops is moderately high • high factor rank
	• disruption of non-adjacent vicinity farm operations	9	-4.6	• high factor rank and suitability level; 2 farms in site vicinity (moderately high) and high livestock density; moderately high proportion of land in crops
- Natural Environment	• fish and wildlife features of significance	2	-5.0	• high factor suitability level • 4 significant features associated with Beaver Creek and the Welland River
	• other natural vegetation	3	-3.0	• relatively high factor suitability level; 298 ha of other natural vegetation (versus 692 ha at most impacted siting option LF-1E/PI-27E)
	• rare species	2	-5.0	• high factor suitability level; high potential impact on rare plant species (1 high, 10 medium and 6 low significance species)
- Air Dispersion/ Air Quality	• existing and anticipated air quality	6	-2.8	• public concern • least constrained along with LF-9C

TABLE C.15

Rationale for Major Risks or Impacts

LF-3C

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
B. Impacts (cont'd)				
• Community and Region				
- Community and Regional	• social stability	8	-4.5	• high factor suitability level and ranking • suitability level indicates that the introduction of a major industrial facility into a predominantly rural/agricultural area could have a substantial effect because changes may not meet municipal objectives; the option is also potentially most impacted through voluntary out-migration
	• social cohesion	6	-5.0	• high factor suitability level; the more stable and slower growing municipalities will be more impacted because new households may not replace those displaced and interdependence amongst people and provision of facilities may be affected (e.g. Elcho United Church facilities may be disrupted) • the highest potential out-migration was also measured for LF-3C
	• community character	8	-4.5	• high factor suitability level and factor rank • suitability level reflects dominance of agriculture and a farming lifestyle in West Lincoln that is not compatible with the image and character of a heavy industry
	• regional and community economic base	8	+2.0	• relatively high factor rank
	• municipal finance	6	+4.9	• high factor suitability level; municipal tax base is small and levels of service are low therefore payments in lieu of taxes is relatively large and financial costs will be less; property value impacts expected to be relatively small
- Land Use	• existing land use	4	-3.3	• relatively high factor suitability level; basic incompatibility with rural/agricultural land use (LKA, 1985, p.129)
	• planned and proposed land use	4	-3.8	• relatively high factor suitability level; basic incompatibility with rural/agricultural future land use (LKA, 1985, p.129)

TABLE C.15

Rationale for Major Risks or Impacts

LF-3C

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
B. Impacts (cont'd)				
- Agricultural Resources	• stability of farm population	9	-4.6	• high factor rank and suitability level • stable farming area • high proportion of young (more vulnerable) operators (under age 55) and moderately high number of full-time operators dependent on agriculture as main income source
	• stability of agricultural land base	8	-4.4	• high factor rank • stable land base; factor suitability is high; area is relatively free of urbanizing pressures reflected in high amount of owner-operated land and large parcels, and farmed land
	• disruption to the farm economy	8	-4.5	• high factor rank • high factor suitability level; relatively high potential for impact on farm economy; gross farm revenue and relative exposure of crops and livestock to stack and fugitive emissions are relatively low but amount of downstream livestock is high
• Access Roads				
- Residents	• disruption of day-to-day activities and/or the use and enjoyment of property (adjacent)	8	-5.0	• high factor rank • high factor suitability level; highest number of adjacent residents and greatest proportion of residents whose age characteristics could make them more sensitive to the increase in truck traffic
	• disruption of day-to-day activities and/or the use and enjoyment of property (vicinity)	7	-5.0	• high factor suitability level • suitability level reflects highest number of residents in the vicinity (1,794) and within noise impact zone (1,170) due to R.R. 24 passing through Vineland and residences along Hwy. 20 (notably in Bismarck)

TABLE C.15

Rationale for Major Risks or Impacts

LF-3C

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
B. Impacts (cont'd)				
- Community and Recreation Features	• disruption of operations of community and recreation features (adjacent)	2	-5.0	• high factor suitability level • suitability level reflects that this option has the greatest number of features (18) and sensitive features (19) located adjacent to the access route
	• disruption of operations of community and recreation features (vicinity)	1	-4.6	• high factor suitability level; second highest number of features (15) and highest number of sensitive features (17) in the access route vicinity and highest number of features and second highest number of sensitive features in the noise impact zone
- Land Use	• existing land uses	4	-5.0	• high factor suitability level; passes through existing development in Vineland area
	• planned and proposed land uses	4	-5.0	• high factor suitability level; passes through future urban development in Vineland area (residential)
- Agricultural Resources	• disruption of farm traffic and cattle crossings	8	-5.0	• high factor suitability level and factor ranking • factor suitability level reflects moderately high potential conflict with agricultural vehicles and high number of cattle crossings for local roads (Krick Road is used to move cattle during grazing season)
- Agricultural Resources (cont'd)	• disruption to crop and livestock production	4	-5.0	• high factor suitability level; the amount of adjacent crops, livestock and downstream livestock all rate high which indicates high potential for impact in the event of a spill on the access road
- Natural Environment	• fish communities	4	-3.0	• relatively high factor suitability level; medium constraint for regionally significant fishery and high constraint for locally significant fishery

TABLE C.16

Rationale for Major Risks or Impacts

LF-9C

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
A. **RISK**				
• **Transportation**	• annual province-wide hazard-based spill index of OWMC generated transport	8	-3.3	• relatively high factor suitability level; second highest spills index due to motor vehicle accidents (along with LF-9C) and second highest spills index due to non-motor vehicle accidents (along with LF-3C) of all siting options • high factor rank
	• annual province-wide accident involvements of OWMC generated transport	8	-3.2	• relatively high factor suitability level; second highest index for annual accident involvements by OWMC generated trucks (along with LF-3C) • high factor rank
	• transportation risks on local and regional access roads due to accident involvements of OWMC generated transport	10	-4.6	• high factor suitability level; second highest road user risk index; large percentage of access route on local and regional access roads • high factor rank
	• transportation risks on local and regional access roads due to hazard-based spills of OWMC generated transport	10	-3.9	• relatively high factor suitability level; second highest population risk index; second highest road user risk index, second highest sensitive uses risk index
• **Air Quality**	• risk from direct inhalation of emissions-chronic	9	-1.5	• high factor rank
	• risk from direct inhalation of emissions-acute	8	-2.9	• high factor rank
	• risk from ingestion of cistern and pond water	6	-1.5	• public concern
	• risk from consumption of crops and livestock	5	-5.0	• high factor suitability level; high values for future sensitive crop and livestock exposures - fugitive emissions; most constrained siting option (along with LF-3C)
• **Hydrogeologic Suitability**	• capability of providing natural containment	10	-1.0	• high factor rank

TABLE C.16

Rationale for Major Risks or Impacts

LF-9C

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
A. **RISK** (cont'd)				
• **Hydrogeologic Suitability** (cont'd)	• ground water use	7	-5.0	• high factor suitability level; underlain by a potentially significant aquifer
B. **ENVIRONMENTAL IMPACTS**				
• **Site**				
- Residents	• displacement of residents	9	-1.3	• high factor rank
- Land Use	• planned and proposed land use	7	-5.0	• high factor suitability level; generally agricultural land use designations with protective policies and few vacant lots of record; incompatibility with future land use
	• land use stability	2	-3.6	• relatively high factor suitability level; moderate proportion of lands under absentee ownership, no land sales and all buildings in good condition, moderate level of stability
- Agricultural Resources	• loss of farmland	6	-2.3	• public concern
- Natural Environment	• rare species	8	-5.0	• high factor suitability level; high potential impact on rare plant and animal species
• **Site Vicinity**				
- Residents	• property value impacts	7	-1.2	• public concern
	• disruption of use and enjoyment of property and/or day-to-day activities (adjacent to site)	10	-2.4	• high factor rank
	• disruption of use and enjoyment of property and/or day-to-day activities (non-adjacent)	9	-4.8	• high factor suitability level; largest number of residents within 55 dBa zone (88); largest number of residents spending most time on properties with 55 dBa noise zone (25); moderate impact with respect to visual intrusion • high factor rank

TABLE C.16

Rationale for Major Risks or Impacts

LF-9C

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
B. **ENVIRONMENTAL IMPACTS** (cont'd)				
- Community and Recreation Features	• disruption of operations of community and recreation features (adjacent to site)	5	0.0	• public concern
	• disruption of operations of community and recreation features (site vicinity)	3	-0.3	• public concern
- Land Use	• existing land use	8	-2.0	• high factor rank
	• planned and proposed land use	7	-4.4	• high factor suitability level; generally agricultural land use designations; no industrial designations; official plan policies are generally protective of agricultural lands; incompatibility with future agricultural land use
	• land use stability	3	-5.0	• high factor suitability level; low proportion of land under absentee ownership; few land sales; steadily rising land values, moderate percentage of buildings in good condition • secondary factor; considered supplementary to other more direct land use, economic, social and agricultural factors
- Agricultural Resources	• partial displacement of farms	9	-2.3	• high factor rank
	• disruption of adjacent farm operations	10	-4.6	• high factor suitability level; number of farms with headquarters and livestock density are high; moderately high number of operations with owned land • high factor rank
	• disruption of non-adjacent farm operations	9	-5.0	• high factor suitability level; livestock densities are very high; number of farms with headquarters is moderately high; proportion of non-adjacent vicinity in crops is high
- Natural Environment	• fish and wildlife features of significance	2	-3.0	• high factor rank • relatively high factor suitability level; two pike spawning areas

TABLE C.16

Rationale for Major Risks or Impacts

LF-9C

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
B. **ENVIRONMENTAL IMPACTS** (cont'd)				
- Air Dispersion/ Air Quality	• existing and anticipated air quality	6	-2.9	• public concern
• **Community and Regional**				
- Community and Regional	• social stability	8	-4.2	• high factor suitability level; high level of existing stability but overall potential for disruption through voluntary out-migration and resident displacement is considered moderate relative to other siting options (IER, 1985a, p.287) • high factor rank
	• community character	8	-4.6	• high factor suitability level; potentially most impacted siting option (along with LF-3C) in terms of land use compatibility (no industrially designated land), area is basically rural/agricultural
	• community and regional economic base	8	+2.4	• high factor ranking
	• municipal finance	6	+5.0	• high factor suitability level; impact of payments-in-lieu of taxes made by OWMC is large compared to municipal tax base; the financial impacts on operating costs of the area municipality are less because of lower levels of service
- Land Use	• existing land use	4	-3.3	• relatively high factor suitability level; limited residential lands, no industrial land use, incompatibility with existing agricultural land use
	• planned and proposed land use	4	-3.8	• relatively high factor suitability level; predominantly agricultural land use designations with minor residential clusters; no industrial lands, official plan policies protect agricultural lands, basic incompatibility with stable agricultural community
- Agricultural Resources	• stability of farm population	9	-5.0	• high factor suitability level; percent of operators under 55 years of age is high; proportion of full-time operators is moderately high • high factor rank

TABLE C.16

Rationale for Major Risks or Impacts

LF-9C

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
B. ENVIRONMENTAL IMPACTS (cont'd)				
- Agricultural Resources (cont'd)	• stability of agricultural land base	8	-5.0	• high factor suitability level; most of the land is owner-operated; farmed and in large parcels; farm residents dominate the total number of residents and a moderate amount of land is of Class I equivalent • high factor rank
	• disruption to farm economy	8	-4.9	• high factor suitability level; gross farm revenue is a moderate amount
• Access Roads				
- Residents	• disruption of day-to-day activities and/or the use and enjoyment of property (adjacent)	8	-3.9	• relatively high factor suitability level; second highest number of residents living adjacent to access route (775) • second highest number of residents whose age characteristics could make them potentially more sensitive to increased truck traffic • high factor rank
	• disruption of day-to-day activities and/or the use and enjoyment of property (vicinity)	7	-4.5	• high factor suitability level; second highest number of residents in access road vicinity (1716) and in the noise impact zone (986) • number of residents affected by increased noise along access route may be overstated
- Community and Recreation Features	• disruption of operations of community and recreation features (adjacent)	2	-3.5	• relatively high factor suitability level; second lowest number of community and recreation features (14) and sensitive features (6) adjacent to access route
	• disruption of operations of community and recreation features (vicinity)	1	-3.4	• relatively high factor suitability level; second potentially least impacted siting option • second lowest number of features (11) but second highest of sensitive features (6) • third highest number of features (17) and sensitive features (7) in noise impact zone

TABLE C.16

Rationale for Major Risks or Impacts

LF-9C

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
B. **ENVIRONMENTAL IMPACTS** (cont'd)				
- Land Use	• existing land use	4	-5.0	• high factor suitability level; highest number of residences and commercial facilities with a high proportion of residential lands en route (along with LF-3C)
	• planned and proposed land use	4	-5.0	• high factor suitability level; access route travels through rural/agricultural area with substantial amounts of residentially designated land; policies protect agricultural lands
- Agricultural Resources	• disruption to farm traffic and cattle crossings	8	-1.5	• high factor ranking • agricultural vehicle impact index is moderate along regional roads
- Natural Environment	• fish communities	4	-3.0	• relatively high factor suitability level; moderate fishery constraint for regionally significant fishery

TABLE C.17

Major Risk Differences

LF-9C vs. LF-3C

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-3C	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
A. **RISK**				
• **Transportation**				
• annual province-wide hazard-based spill index of OWMC generated transport	8	-3.3	-3.3	• no difference between options within same geographic region; difference screened
• annual province-wide accident involvements of OWMC generated transport	8	-3.2	-3.2	• no difference between options within same geographic region; difference screened
• transportation risks on local and regional access roads due to accident involvements of OWMC generated transport	10	-4.6	-5.0	• magnitude of difference between options is minimal; spills predicted once every 0.8 years for LF-3C and once every 1.2 years for LF-9C • difference is minor but factor is most highly ranked; difference included
• transportation risks on local and regional access roads due to hazard-based spills of OWMC generated transport	10	-3.9	-5.0	• difference is spills predicted once every 13.0 years for LF-3C and once every 20.4 years for LF-9C • difference sufficient to warrant inclusion for this most highly ranked factor
• **Air Quality**				
• risk from direct inhalation of emissions - chronic	9	-1.5	-1.1	• LF-3C has slightly lower risk for all indicators of exposure than LF-9C due to lower population at LF-3C • although difference is minimal, factor is highly ranked and therefore difference warrants inclusion
• risk from direct inhalation of emissions - acute	8	-2.9	-2.6	• minor difference in exposure indices between siting options due to difference in population number and distribution • difference is minor but high factor ranking; therefore, difference considered significant

TABLE C.17

Major Risk Differences

LF-9C vs. LF-3C

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-3C	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Air Quality** (cont'd)				
• risk from ingestion of cistern and pond water	6	-1.5	-2.3	• slightly higher exposure indices for LF-3C for both fugitive and stack emissions • difference is minimal, therefore differences does not warrant inclusion
• risk from consumption of crops and livestock	5	-5.0	-5.0	• no difference in overall risk; factor screened
• **Hydrogeologic Suitability**				
• capability of providing natural containment	10	-1.0	-1.0	• characteristics of both options are similar; difference screened despite high ranking of factor
• ground water use	7	-5.0	-1.0	• potential expanded use of underlying aquifer is limited for LF-3C due to water quality problems; LF-9C has potential for future water supply water supply expansion • difference sufficient to warrant inclusion
• **Surface Water Suitability**				
• susceptibility of site to flooding	3	-1.0	-5.0	• LF-9C has only minor flooding constraints and no designated floodplain land; LF-3C has major flooding constraint due to flood prone area along Beaver Creek • differences sufficient to warrant inclusion
• potential for surface water use interference	7	-3.0	-3.0	• no difference between options; difference screened

TABLE C.18

Major Impact Differences

LF-9C vs. LF-3C

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-3C	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
B. **IMPACTS**				
• **Site**				
– **Residents**				
• displacement of residents	9	-1.3	-2.6	• nine residents displaced for LF-9C (fewest) and is potentially least impacted overall; LF-3C results in displacement of 29 residents (second most impacted) • difference sufficient to warrant inclusion
– **Land Use**				
• planned and proposed land use	7	-5.0	-5.0	• no difference between siting options; difference screened
• land use stability	2	-3.6	-5.0	• higher absentee land ownership at LF-9C (30%); 17% absentee land ownership at LF-3C, therefore higher stability • difference warrants inclusion
– **Agricultural Resources**				
• displacement of farms with on-site headquarters	6	-2.6	-4.9	• average farm size owned for LF-9C is 37 ha and gross farm revenue is $53,000; average farm size owned for LF-3C is 65 ha and gross farm revenue is $156,000 • difference sufficient to warrant inclusion
• loss of farmland	6	-2.3	-3.8	• Class 1 equivalent is 90 ha for LF-9C and 19 ha are tile drained; Class 1 equivalent is 135 ha for LF-3C and 57 ha are tile drained • difference sufficient to warrant inclusion
– **Natural Environment**				
• natural vegetation displaced	4	-1.0	-3.0	• 62 ha of natural vegetation displaced for LF-3C and 23 ha displaced for LF-9C • difference sufficient to warrant inclusion

TABLE C.18

Major Impact Differences

LF-9C vs. LF-3C

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-3C	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Site** (cont'd)				
- **Natural Environment**				
• potential for occurrence of other significant features	6	-1.0	-3.0	• moderate to high potential for finding other significant features for the varied habitat of LF-3C; low potential for LF-9C • difference sufficient to warrant inclusion
• rare species	8	-5.0	-1.0	• potential for high impact on rare plant and animal species for LF-9C; relatively low potential impact for LF-3C • difference sufficient to warrant inclusion
• **Site Vicinity**				
- **Residents**				
• disruption of use and enjoyment of property and/or day-to-day activities (adjacent to site)	10	-2.4	-3.4	• LF-3C has 48 adjacent residents of which 23 spend most of time on property; LF-9C has 40 adjacent residents of which 15 spend most of time on property • difference is sufficient to warrant inclusion for this most highly ranked factor
• disruption of use and enjoyment of property and/or day-to-day activities (non-adjacent)	9	-4.8	-2.8	• LF-9C is third most impacted of all siting options; LF-9C has 272 residents within site vicinity (least number), [illegible] residents spending most of the time within the 55 dBA noise impact zone and moderate visual impacts; LF-3C has 765 residents in the site vicinity (third highest includes Robert Land Academy), 6 residents spending most of time within 55 dBA noise impact zone and relatively few overall in noise impact zones, visual intrusion is moderate and is second least impacted overall • difference is sufficient to warrant inclusion
• property value impacts	7	-1.2	-1.2	• no difference between options; difference screened

TABLE C.18

Major Impact Differences

LF-9C vs. LF-3C

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-3C	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• Site (cont'd)				
• Site Vicinity				
– Community and Recreation Features				
• disruption of operations of community and recreation features (adjacent)	5	–	–	• no features adjacent
• disruption of community and recreation features (vicinity)	3	-0.3	-5.0	• LF-3C has more features and sensitive features within site vicinity (1 versus 4 and 2 versus 6) • LF-3C has two features sensitive to noise (Elcho Church and Cemetery) • difference is sufficient to warrant inclusion
– Businesses				
• business activities negatively affected by the presence of OWMC facilities	6	-0.7	-3.1	• few businesses negatively affected for LF-9C (4) and annual sales ($355,000) and number of employees negatively affected (9) are low; nine businesses are affected for LF-3C representing 64 employees and $2,348,000 in annual sales • difference sufficient to warrant inclusion
– Land Use				
• existing land use	8	-2.0	-2.1	• LF-3C has 177 residences within site vicinity; LF-9C has 75 residences within site vicinity • differences are minor but factor highly ranked, therefore difference included
• planned and proposed land use	7	-4.4	-4.5	• no significant difference in proposed and planned land use; difference screened
• land use stability	3	-5.0	-5.0	• no significant difference in land use stability; difference screened

TABLE C.18

Major Impact Differences

LF-9C vs. LF-3C

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-3C	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Site Vicinity** (cont'd)				
– Agricultural Resources				
• partial displacement of farms	9	-2.3	-5.0	• LF-3C has 3 farms with headquarters affected by partial displacement, average parcel size is 47 ha and proportion of land base lost is 18% owned and 32% rented; indicators are lower for LF-9C - 1 farm affected, average parcel size is 20 ha and 16% owned land base is lost • differences sufficient to warrant inclusion
• disruption of adjacent farm operations	10	-4.6	-3.7	• minor differences between options; LF-3C has five farms with headquarters, 10 operators with owned land and 0.32 livestock density (animal units/ha); LF-9C has 6 farms with headquarters, 8 operators with owned land and 1.14 livestock density (animal units/ha • although differences are minor, this factor is most highly ranked and therefore differences are included
• disruption of non-adjacent vicinity operations	9	-5.0	-4.6	• differences are minor; LF-3C has 32 farms with headquarters, 61% non-adjacent vicinity in crops and 1.09 animal units/ha; LF-9C has 23 farms with headquarters, 71% non-adjacent vicinity in crops and 2.44 animal units/ha • differences minor but factor highly ranked, therefore differences are included
– Natural Environment				
• fish and wildlife features of significance	2	-3.0	-5.0	• LF-3C has four features (3 pike spawning areas and 1 waterfowl production area); LF-9C has 2 pike spawning areas • differences sufficient to warrant inclusion
• other natural vegetation	3	-1.0	-3.0	• LF-3C has approximately 298 ha of other natural vegetation; LF-9C has approximately 111 ha of other natural vegetation • difference sufficient to warrant inclusion
– Air Quality/Air Dispersion				
• existing and anticipated air quality	6	-2.9	-2.8	• slightly better existing air quality for LF-3C • differences not considered sufficient to warrant inclusion

TABLE C.18

Major Impact Differences

LF-9C vs. LF-3C

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-3C	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Site Vicinity** (cont'd)				
• **Community and Regional**				
– Community and Regional				
• social stability	8	-4.2	-4.5	• LF-3C would be second least disrupted through the displacement of residents and potentially most impacted through voluntary out-migration of residents; LF-9C would be moderately impacted through voluntary out-migration and resident displacement • minor difference between options but factor highly ranked, therefore difference included
• social cohesion	6	-1.0	-5.0	• although both communities are stable and slow growing and therefore more vulnerable to change, LF-3C is potentially most impacted through resident out-migration and has moderate potential for disruption through resident displacement; LF-9C has the smallest displacement, and lowest voluntary out-migration potential of any option
• community character	8	-4.6	-4.5	• LF-3C is primarily rural (like LF-9C) but Oswego Park subdivision to the south of the site; LF-3C slightly lower heritage features and visual impacts than LF-9C • differences minor but factor highly ranked, therefore differences included
• community and regional economic base	8	+2.4	+2.0	• minor differences between options; LF-9C has 356 new jobs created and 211 new households created, LF-9C has 316 new jobs created and 200 new households created • differences are minor but factor highly ranked, therefore differences included
• municipal finance	6	+5.0	+4.9	• minor differences between options; net financial impact on regional municipality is $199,000 for LF-9C and $196,000 for LF-3C • differences are not sufficient to warrant inclusion
– Land Use				
• existing land use	4	-3.3	-3.3	• no difference between options; difference screened

TABLE C.18

Major Impact Differences

LF-9C vs. LF-3C

FACTOR GROUP	RANKING AND SUITABILITY	LF-9C	LF-3C	MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Community and Regional** (cont'd)				
- **Land Use**				
• planned and proposed land use	4	-3.3	-3.3	• no difference between option; difference screened
- **Agricultural Resources**				
• stability of farm population	9	-5.0	-4.6	• percent of full-time operators is 60 for LF-9C and 52 for LF-3C • differences are not sufficient to warrant inclusion
• stability of agricultural land base	8	-5.0	-4.4	• LF-9C has slightly more stable land base; 91% of land parcels are large (vs. 82% at LF-3C), 76% of farmland is owned (vs. 74% at LF-3C), 94% of the area is farmed (vs. 91% at LF-3C), 58% of residences are farm residences (vs. 36% at LF-3C, 69% of land is agriculturally designated (vs. 70% of LF-3C), and 100% of land is privately owned (vs. 98% at LF-3C) • differences are minor but factor highly ranked, therefore difference included
• disruption to farm economy	8	-4.9	-4.5	• differences are minor; gross farm revenue is 8.6 million (1981) for LF-9C, livestock index is higher for exposure to fugitive emissions at LF-9C and crop index for exposure to stack emissions is slightly higher; gross farm revenue is 6.9 million (1981) for LF-3C and livestock-index for exposure to stack emissions is slightly higher for LF-3C • differences considered minor but factor highly ranked, therefore difference included
• **Access Roads**				
- **Residents**				
• disruption of day-to-day activities and/or the use and enjoyment of property (adjacent)	8	-3.9	-5.0	• 993 residents adjacent to access routes for LF-3C and more residents in vulnerable age groups than for LF-9C; LF-9C has 775 adjacent residents • differences sufficient to warrant inclusion

TABLE C.18

Major Impact Differences

LF-9C vs. LF-3C

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-3C	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• Access Roads				
- Residents				
• disruption of day-to-day activities and/or the use and enjoyment of property (vicinity)	7	-4.5	-5.0	• LF-3C has 1,794 residents within the access road vicinity and 1,170 within the noise impact zone; LF-3C has 1,716 residents within the access road vicinity and 986 within the noise impact zone • difference not significant; differences screened
- Community and Recreation				
• disruption of operations of community and recreation features (adjacent)	2	-3.5	-5.0	• LF-3C has 18 features and nine sensitive features adjacent to access roads; LF-9C has 14 features and six sensitive features adjacent to the access roads • negligible difference between options; difference screened • difference sufficient to warrant inclusion
• disruption of operations of community and recreation features (vicinity)	1	-3.4	-4.6	• LF-3C has more features and sensitive features within noise impact zone than LF-9C (21 vs. 17 and 11 vs. 7, respectively) and more features and sensitive features in the access road vicinity (13 vs. 11 and 7 vs. 6, respectively) • difference is sufficient to warrant inclusion
- Land Use				
• existing land use	4	-5.0	-5.0	• no difference between options; difference screened
• planned and proposed land use	4	-5.0	-5.0	• no difference between options; difference screened
- Agricultural Resources				
• disruption to farm traffic and cattle crossing	8	-1.5	-5.0	• no farm traffic or cattle crossings on local roads for LF-9C and higher agricultural vehicle impact index for regional roads for LF-3C (85.4 vs. 36.4)

Impact Differences

LF-9C vs. LF-3C

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-3C	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Access Roads** (cont'd)				
- **Agricultural Resources**				
• disruption to crop and livestock production	8	-2.6	-5.0	• for LF-3C adjacent crops are 3,600 ha, 848 animal units and downstream livestock is 48; LF-9C has 2,366 ha of adjacent crops, [illegible],30 animal units and 32 downstream livestock • difference sufficient to warrant inclusion
- **Natural Environment**				
• fish communities	4	-3.0	-3.0	• no difference between options; difference screened

TABLE C.19

Rationale for Major Risks or Impacts

LF-1E

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
A. **RISK**				
• Transportation	• annual province-wide hazard-based spill index of OWMC generated transport	8	-5.0	• high factor rank and suitability level; high annual accident related spills and annual non-accident related spills relative to other siting options (total 1 every 5.5 years) • province-wide system risk is equal for siting options within the same geographic area (i.e. LF-1E and LF-1E/PI-27E)
	• annual province-wide accident involvements of OWMC generated transport	8	-5.0	• high factor rank and suitability level; high annual accident involvement relative to other siting options (2.1 per year) • province-wide system risk is equal for siting options within the same geographic area
• Air Quality	• risk from direct inhalation of emissions - chronic	9	-2.4	• high factor rank
	• risk from direct inhalation of emissions - acute	8	-3.8	• high factor rank
	• risks from ingestion of cistern and pond water	6	-5.0	• high factor suitability level; highest relative exposure from cistern and pond water for both incinerator and fugitive emissions

TABLE C.19

Rationale for Major Risks or Impacts

LF-1E

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
A. **RISK** (cont'd)				
• **Air Quality**	• risks from consumption of crops and livestock	5	-1.7	• public concern • second highest relative exposure from consumption of crops and livestock
• **Hydrogeologic Suitability**	• capability of providing natural containment	10	-5.0	• high factor rank and factor suitability level; locally variable confining layer
	• ground water use	7	-5.0	• high factor suitability level; aquifer may be capable of meeting more stringent water use requirements
• **Surface Water Suitability**	• potential for surface water use	7	-1.0	• public concern • low downstream water use index and no local stream takings for potable supply

TABLE C.19

Rationale for Major Risks or Impacts

LF-1E

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
B. IMPACTS				
• **Site**				
- **Residents**	• displacement of residents	9	-4.0	• high factor rank and suitability level; greatest number of residents displaced (43); second most impacted due to their characteristics; most impacted for attachment to place
- **Businesses**	• displacement of businesses	4	-3.6	• relatively high factor suitability level; 6 businesses displaced and moderately high annual sales ($1,741,000)
- **Land Use**	• existing land use	6	-4.7	• high factor suitability level; high number of residences (16) and some commercial use on site (1)
	• proposed and planned land uses	7	-4.7	• high factor suitability level; basic incompatibility with proposed agricultural future use (LKA, 1985, p.129)
	• land use stability	2	-4.1	• high factor suitability level; moderately high level of stability for area; 100% rural agricultural and 33% of area in absentee ownership, no land sales or development proposals • factor considered supplementary to other measures of social change
- **Agricultural Resources**	• displacement of farms with on-site headquarters	6	-3.9	• relatively high factor suitability level; many farm operations with headquarters, all of which are owner operated (7), but with relatively small average size, estimated gross farm revenue is moderately low
	• loss of farmland	6	-3.4	• relatively high factor suitability level; no tile drained on-site; Class 1 equivalent rating is 177 ha
- **Natural Environment**	• natural vegetation displaced	4	-5.0	• relatively high factor suitability level; approximately 92 ha displaced (moderate amount)

TABLE C.19

Rationale for Major Risks or Impacts

LF-1E

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
B. **IMPACTS** (cont'd)				
- Natural Environment (cont'd)	• potential for occurrence of other significant features	6	-5.0	• high factor suitability level; considerable area of natural vegetation on-site and high probability of finding more rare species
• **Site Vicinity**				
- Residents	• disruption of use and enjoyment of property and/or day-to-day activities (adjacent to site)	10	-1.3	• high factor rank
	• disruption of use and enjoyment of property and/or day-to-day activities (non-adjacent)	9	-2.7	• high factor rank
	• property value impacts	7	-1.8	• public concern • potential for $679,000 change in property value (moderately low) (Clayton, 1985a)
- Community and Recreation Features	• disruption of operations of community and recreation features (adjacent to site)	5	-	• public concern • no features
	• disruption of operations of community and recreation features (site vicinity)	3	-1.7	• public concern • LF-1E has six sensitive features and 14 features within site vicinity
- Land Use	• existing land use	8	-3.6	• relatively high factor rank and relatively high factor suitability level • suitability level reflects incompatibility with agricultural and residential land
	• proposed and planned land use	7	-4.4	• high factor suitability level; basic incompatibility with agricultural land use designations and no industrial designations
	• land use stability	3	-3.6	• relatively high factor suitability level reflects relatively stable land use in area • factor considered supplementary to other measures of social change

TABLE C.19

Rationale for Major Risks or Impacts

LP-1E

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
B. IMPACTS (cont'd)				
- Agricultural Resources	• partial displacement of farms (off-site farms with on-site land)	9	-4.3	• high factor rank and suitability level • factor suitability level reflects moderately high proportion of land base lost (25% owned and 35% rented) for relatively small number of farms losing land (2 farms with headquarters)
	• disruption of adjacent farm operations	10	-2.1	• high factor rank
	• disruption of non-adjacent farm operations	9	-2.9	• high factor rank
- Natural Environment	• significant environmental units (SEUs)	4	-3.0	• relatively high factor suitability level reflects areal extent of SEU (386 ha which is second largest area)
	• fish and wildlife features of significance	2	-3.0	• relatively high factor suitability level due to 2 pike spawning areas in Grassy Brook and unnamed stream draining northern edge of site vicinity
	• other natural vegetation	3	-3.0	• relatively high factor suitability level reflects second largest area (333 ha) of other natural vegetation (deciduous forest, coniferous forest, mixed forest, thicket, successional field and wetland)
- Air Dispersion/ Air Quality	• existing and anticipated air quality	6	-3.5	• relatively highly constrained existing air quality
• Community and Region				
- Community and Regional	• social stability	8	-4.9	• high factor rank and suitability level

TABLE C.19

Rationale for Major Risks or Impacts

LF-1E

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
B. **IMPACTS** (cont'd)				
- Community and Regional (cont'd)				• suitability level reflects that option is third most stable siting option as demonstrated by stability index; resident displacement is second highest; least disrupted by voluntary migration • this high level of impact is tempered by fact that community is relatively diverse and able to adjust to change (compared to West Lincoln), but less so than for Milton
	• social cohesion	6	-4.6	• high factor suitability level reflects that option is second most impacted in terms of resident displacement, but least impacted in terms of resident out-migration; Lyons Creek Church contributes to social cohesion and could be impacted • Niagara Falls is a more stable and slower growing municipality than Milton and may be impacted more
	• community character	8	-4.0	• high factor rank and suitability level • high suitability level reflects that potential impact on land use compatibility and heritage features is second least and visual impacts are lowest; however, area is primarily agricultural/rural which is generally incompatible with an industrial facility
	• regional and community economic base	8	+4.5	• high factor rank and suitability level which reflects a relatively high positive impact due to the number of new jobs created (395) and households added (281) and high potential for industrial spin-off
	• tourism economy	8	-5.0	• high factor rank and suitability level • largest potential impact on tourism economy due to high level of existing and planned tourism visitation, revenues and employment
- Agricultural Resources	• stability of farm population	8	-2.6	• high factor rank

TABLE C.19

Rationale for Major Risks or Impacts

LF-1E

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
B. **IMPACTS** (cont'd)				
- Agricultural Resources	• stability of agricultural land base	8	-3.4	• high factor rank and relatively high suitability level • 62% of the area is farmed and 39% is owned farmland; 53% of the land is in parcels over 12.6 ha; agriculturally designated land (Class 1 equivalent) is 72% and 99% of the land is privately owned
	• disruption to the farm economy	8	-1.5	• high factor rank

TABLE C.20

Rationale for Major Risks or Impacts

LF-1E/PI-27E

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
A. **Risk**				
• Transportation	• annual province-wide hazard-based spill index of OWMC generated transport	8	-5.0	• relatively high factor suitability level; highest spills index due to motor vehicle accidents (along with LF-1E) and highest spills index due to non-motor vehicle accidents (along with LF-1E) of all siting options • high factor rank
	• annual province-wide accident involvements of OWMC generated transport	8	-5.0	• high factor suitability level; highest index for annual accident involvements by OWMC generated trucks (along with LF-1E) of all siting options • high factor rank
• Air Quality	• risk from direct inhalation of emissions - chronic	9	-5.0	• high factor suitability level; high relative population exposure - incinerator stack emissions, high relative population exposure - fugitive emissions, high relative future population exposure - fugitive emissions • high factor rank
	• risk from direct inhalation of emissions - acute	8	-4.1	• high factor suitability level; high relative population exposure - upset emissions from incinerator stack, high relative future population exposure - upset emissions from incinerator stack • high factor rank
	• risk from consumption of crops and livestock	5	-1.3	• public concern
• Surface Water Suitability	• potential for surface water use interference	7	-0.8	• public concern
	• susceptibility of site to flooding	3	-3.0	• relatively high factor suitability level; second lowest relative level of constraint due to large upstream area for Grassy Brook (GLAL, 1985c)
• Hydrogeologic Suitability	• capability of providing natural containment	10	-5.0	• high factor suitability level; confining layer varies under both sites as a result of locally occurring geologic features, sand layers could be present within the confining layer under portions of both sites, contaminant breakthrough times are anticipated to vary locally at both sites as a result of variable confining layer thicknesses • high factor rank

TABLE C.20

Rationale for Major Risks or Impacts

LF-1E/PI-27E

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
A. **Risk** (cont'd)				
• **Hydrogeologic Suitability** (cont'd)	• ground water use	7	-5.0	• high factor suitability level; ground water supplies may be developed in either the Guelph formation or shallow granular aquifers, aquifer may be capable of meeting more stringent water use requirements • public concern
B. **Environmental Impacts**				
• **Site**				
- Residents	• displacement of residents	9	-5.0	• high factor suitability level; second highest number of residents on-site (42), residents potentially most impacted due to their characteristics and second most impacted due to their attachment to place than any other siting option • high factor rank
- Businesses	• displacement of businesses	4	-5.0	• high factor suitability level; high number of businesses displaced (7), high estimated annual sales ($2.6 million)
- Land Use	• existing land use	6	-5.0	• high factor suitability level; high number of residences and some commercial or industrial facilities/uses on-site, conflict with existing residential land use, basic agricultural conflict (LF-1E)
- Agricultural Resources	• loss of farmland	6	-1.7	• public concern
- Natural Environment	• rare species	8	-5.0	• high factor suitability level; high potential impact on rare plant species • high factor rank
	• natural vegetation displaced	4	-3.0	• relatively high factor suitability level; approximately 67 ha natural vegetation displaced
	• potential for occurrence of other significant features	6	-5.0	• high factor suitability level; high potential on both sites to find additional rare species

TABLE C.20

Rationale for Major Risks or Impacts

LF-1E/PI-27E

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
B. Environmental Impacts (cont'd)				
• Site Vicinity				
- Residents	• property value impacts	7	-2.8	• public concern
	• disruption of use and enjoyment of property and/or day-to-day activities (adjacent to site)	10	-2.1	• high factor rank
	• disruption of use and enjoyment of property and/or day-to-day activities (non-adjacent)	9	-3.6	• relatively high factor suitability level; second highest number of residents in site vicinity (850), but potential number of residents affected by noise impact and visual intrusion are relatively low as compared to the other siting options • high factor rank
- Businesses	• business activities negatively affected by the presence of OWMC facilities	4	-3.3	• relatively high factor suitability level; moderately high number of businesses negatively affected (12), moderately high annual sales ($2.1 million) and number of employees affected (69)
	• business activities positively affected by the presence of OWMC facilities	6	+5.0	• high factor suitability level; high number of businesses (12) and employees (1450) positively affected, high estimated annual sales ($81.9 million) of businesses positively affected
- Community and Recreation Features	• disruption of operations of community and recreation features (adjacent to site)	5	-5.0	• high factor suitability level; greatest potential impact (along with LF-4N/PI-13N) on community and recreation features adjacent to site, two features located adjacent to site - Arpad Hungarian Cultural Centre and Grassybrook Park
	• disruption of operations of community and recreation features (site vicinity)	3	-4.0	• high factor suitability level; second most impacted siting option, one sensitive feature in noise impact zone, highest number of features (20) and second highest number of sensitive features (6) (along with LF-1E and LF-4N/PI-1N)
- Land Use	• existing land use	8	-3.6	• relatively high factor suitability level; large number of residences within 1000 m, conflict with existing residential land use • high factor rank

TABLE C.20

Rationale for Major Risks or Impacts

LF-1E/PI-27E

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
B. **Environmental Impacts** (cont'd)				
- Land Use (cont'd)	• land use stability	3	-3.6	• relatively high factor suitability level; moderate proportion of lands under absentee ownership, relatively few land sales, moderate percentage of building of good quality
- Agricultural Resources	• partial displacement of farms	9	-3.6	• relatively high factor suitability level; proportion of those owned farms losing land on-site is moderately high • high factor rank
	• disruption of adjacent farm operations	10	-2.8	• high factor rank
	• disruption of non-adjacent farm operations	9	-2.4	• high factor rank
- Natural Environment	• significant environmental units (SEUs)	4	-5.0	• high factor suitability level; greatest potential impact on SEUs of all siting options (636 ha)
	• fish and wildlife features of significance	2	-5.0	• high factor suitability level; four features of significance including three pike spawning areas and one waterfowl production area
	• other natural vegetation	3	-5.0	• high factor suitability level; largest areal extent of natural vegetation (692 ha) of all siting options
	• rare species	2	-3.0	• relatively high factor suitability level; high potential impact on rare animal species and low potential impact on rare plant species
- Air Dispersion/ Air Quality	• existing and anticipated air quality	6	-5.0	• high factor suitability level; high values for existing air quality and existing short term air quality; existence of polluting industries in vicinity of siting option; however, incremental effects expected to be minimal

TABLE C.20

Rationale for Major Risks or Impacts

LF-1E/PI-27E

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
B. Environmental Impacts (cont'd)				
• Community and Regional				
- Community and Regional	• social stability	8	-5.0	• high factor suitability level; potentially most impacted of all siting options, siting option has the highest level of existing stability (along with LF-9C), stability is most disrupted through resident displacement and third most disrupted through voluntary out-migration of residents • high factor rank
	• social cohesion	6	-4.6	• high factor suitability level; second highest impact on social cohesion of all siting options, second highest impact on cohesion through resident displacement and resident out-migration, Lyons Creek United Church identified as feature contributing to social cohesion
	• community character	8	-3.8	• relatively high factor suitability level; potentially least impacted siting option, least potential impact in terms of heritage features and second least impact in terms of visual compatibility • high factor rank
	• community and regional economic base	8	+5.0	• high factor suitability level; high number of new jobs and households created, perceptions among community businesses balanced between positive and negative on the possible effects of the facility • high factor rank
	• tourism economy	8	-5.0	• high factor suitability level; potentially most impacted siting option with regard to tourism economy • high factor rank
	• tourism operations	6	-5.0	• high factor suitability level; potentially most impacted siting options with regard to impacts on tourism operations
- Land Use	• existing land use	4	-3.3	• relatively high factor suitability level; significant amounts of residential land use, but this is largely offset by the substantial compatible industrial lands in the area

TABLE C.20

Rationale for Major Risks or Impacts

LF-1E/PI-27E

FACTOR GROUPING	MAJOR RISK OR IMPACT	FACTOR RANK	FACTOR SUITABILITY LEVEL	REASONS FOR MAJOR RISK OR IMPACT
B. **Environmental Impacts** (cont'd)				
- Agricultural Resources	• stability of farm population	9	-2.6	• high factor rank
	• stability of agricultural land base	6	-2.8	• high factor rank
	• disruption to farm economy	8	-1.3	• public concern

TABLE C.21

Major Risk Differences

LF-1E vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-1E	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
A. **RISK**				
• **Transportation**				
• annual province-wide hazard-based spill index of OWMC generated transport	8	-5.0	-5.0	• no difference for options within the same geographic area • difference screened
• annual province-wide accident involvements of OWMC generated transport	8	-5.0	-5.0	• no difference for options within the same geographic area • difference screened
• transportation risks on local and regional access roads due to accident involvements of OWMC	10	-0.2	-0.2	• no difference between options; difference screened
• transportation risks on local and regional access roads due to hazard-based spills of OWMC generated transport	10	-0.2	-0.2	• no difference between options; difference screened
• **Air Quality**				
• risk from direct inhalation of emissions - chronic	9	-2.4	-5.0	• significant differences between options for all indicators; population exposure to fugitive emissions much greater for LF-1E/PI-27E (699 versus 1,808 - index)
• risk from direct inhalation of emissions - acute	9	-3.8	-4.1	• higher values for LF-1E/PI-27E for upset emissions from incinerator stack than for LF-1E; higher values for LF-1E for upset emissions from low elevation sources • overall differences minimal but factor highly ranked and therefore difference included

TABLE C.21

Major Risk Differences

LF-1E vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-1E	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Air Quality**				
• risk from ingestion of cistern and pond water	6	-5.0	-1.0	• much higher values for LF-1E for both exposure from cistern and pond water for both stack and fugitive emissions • difference sufficient to warrant inclusion
• risks from consumption of crops and livestock	5	-1.3	-1.7	• LF-1E/PI-27E has slightly lower exposure indices for all indicators • difference not considered sufficient to warrant inclusion
• **Hydrogeologic Suitability**				
• capability of providing natural containment	10	-5.0	-5.0	• no difference between options; difference screened
• ground water use	7	-5.0	-5.0	• no difference between options; difference screened
• **Surface Water Suitability**				
• potential for water use interference	7	-1.0	-1.0	• no difference between options; difference screened

TABLE C.22

Major Impact Differences

LF-1E vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-1E	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
B. **IMPACTS**				
• **Site**				
– **Residents**				
• displacement of residents	9	-4.0	-5.0	• LF-1E has the greatest number of residents displaced (43) and is second most impacted due to their characteristics; LF-1E/PI-27E has second highest number of residents displaced (42) but residents potentially most impacted due to their characteristics and second most impacted due to their attachment to place • differences sufficient to warrant inclusion
– **Businesses**				
• displacement of businesses	4	-3.6	-5.0	• LF-1E has six businesses displaced and moderately high annual sales ($1,741,000); LF-1E/PI-27E has seven businesses displaced and high annual sales ($2.6 million) • differences sufficient to warrant inclusion
– **Land Use**				
• existing land use	6	-4.7	-5.0	• PI-27E has additional rural/vacant (97%) and industrial uses (37%) • differences minor; differences screened
• proposed and planned land use	7	-4.7	-2.7	• PI-27E is 100% industrially designated which is compatible with the OWMC facility • difference sufficient to warrant inclusion
• land use stability	2	-4.1	-2.5	• greater instability for LF-1E/PI-27E; addition of PI-27E increases absentee ownership from 33-52% for area and 16-25% for property and adds two land sales • differences sufficient to warrant inclusion

TABLE C.22

Major Impact Differences

LF-1E vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-1E	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Site** (cont'd)				
- **Agricultural Resources**				
• displacement of farms with on-site headquarters	6	-3.9	-2.9	• for LF-1E, seven farm operations owned, 0 rented; average farm size is only 27 ha and gross farm revenue is $36,800 (1984); LF-1E/PI-27E has five farm operations owned, 0 rented; average farm size is 22 and gross farm revenue is $26,000 differences are sufficient to warrant inclusion
• loss of farmland	6	-3.4	-1.7	• Class 1 equivalent for LF-1E is 177 and for LF-1E/PI-27E is 91 • differences are sufficient to warrant inclusion
- **Natural Environment**				
• rare species	8	-1.0	-5.0	• low potential impact on both rare plant and animal species for LF-1E; high potential impact on rare plant species with LF-1E/PI-27E (GLAL, 1985a) • difference sufficient to warrant inclusion
• natural vegetation displaced	4	-5.0	-3.0	• approximately 92 ha displaced for LF-1E and 67 ha displaced for LF-1E/PI-27E • difference sufficient to warrant inclusion
• potential for occurrence of other significant features	6	-5.0	-5.0	• no difference between options; difference screened

TABLE C.22

Major Impact Differences

LF-1E vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-1E	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Site Vicinity**				
- **Residents**				
• disruption of use and enjoyment of property and/or day-to-day activities (adjacent to site)	10	-1.3	-2.1	• six residents adjacent to site LF-1E and spending most of time on property and 31 adjacent to the site; 11 residents adjacent to LF-1E/PI-27E and spending most of time on property and 42 adjacent • although magnitude of difference is not great, the factor is ranked most highly and therefore differences are considered sufficient to warrant inclusion
• disruption of use and enjoyment of property and/or day-to-day activities (non-adjacent)	9	-2.7	-3.6	• LF-1E has 6 residents in site vicinity and spending most of time on property, least impact in terms of visual intrusion and second least impacted in terms of noise; LF-1E/PI-27E has nine residents in site vicinity spending most of time on property, and has low visual and • although magnitude of difference is not great, the factor is highly ranked and therefore differences are considered sufficient to warrant inclusion noise impacts
• property value impacts	7	-1.8	-2.8	• LF-1E has potential for $679,000 change in property value and LF-1E/PI-27E has potential for $1,050,000 change in property value • magnitude of difference is not great therefore not considered sufficient to warrant inclusion
- **Businesses**				
• business activities negatively affected by the presence of OWMC facilities	6	-1.3	-3.3	• LF-1E has six businesses negatively affected representing 18 employees and $1,333,000 in annual sales; LF-1E/PI-27E has 12 businesses negatively affected representing 69 employees and $2,192,000 in annual sales • differences considered sufficient to warrant inclusion
• business activities positively affected by the presence of OWMC facilities	4	+0.1	+5.0	• LF-1E has one business positively affected representing two employees and $100,000 annual sales; LF-1E/PI-27E has 12 businesses positively affected representing 1,450 employees and $5,368,000 annual sales

TABLE C.22

Major Impact Differences

LF-1E vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-1E	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Site Vicinity** (cont'd)				
- **Community and Recreation Features**				
• disruption of operations of community and recreation features (adjacent to site)	5	-	-5.0	• only impacts are for LF-1E/PI-27E (two features adjacent to site); differences sufficient to warrant inclusion
• disruption of operations of community and recreation features (site vicinity)	3	-1.7	-4.0	• LF-1E has six sensitive features and 14 features within site vicinity; LF-1E/PI-27E has six sensitive features and 20 feature within site vicinity and one within noise impact zone • differences sufficient to warrant inclusion
- **Land Use**				
• existing land use	8	-3.6	-3.6	• no difference between options; difference screened
• proposed and planned land use	7	-4.4	-2.7	• LF-1E has generally agricultural land use designations but no industrial designations (incompatible with OWMC facility); LF-1E/PI-27E has generally agricultural land use designations with substantial amounts of compatible industrial designations • differences sufficient to warrant inclusion
• land use stability	3	-3.6	-3.6	• no difference between options; difference screened
- **Agricultural Resources**				
• partial displacement of farms	9	-4.3	-3.6	• average parcel size of displaced farms is higher for LF-1E (20 ha vs. 13 ha) and proportion of rented land base lost is higher (35% vs. 11%) for LF-1E • difference minor but high factor rank, therefore sufficient to warrant inclusion

TABLE C.22

Major Impact Differences

LF-1E vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-1E	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Site Vicinity** (cont'd)				
- **Agricultural Resources** (cont'd)				
• disruption of adjacent farm operations	10	-2.1	-2.8	• LF-1E has three adjacent farms with headquarters, five operators with owned land and a livestock density of 0.26 animal units/ha; LF-1E/PI-27E has four adjacent farms with headquarters, seven operators with owned land and a livestock density of 0.27 animal units/ha • although differences are of low magnitude, the factor is highest ranked and therefore the differences are considered sufficient to warrant inclusion
• disruption of non-adacent vicinity operations	9	-2.9	-2.4	• LF-1E has a higher proportion of non-adjacent vicinity in crops (41% vs. 22%) • although differences are minor, factor is highly ranked and therefore differences are considered sufficient to warrant inclusion
- **Natural Environment**				
• significant environmental units (SEUs)	4	-3.0	-5.0	• LF-1E has approximately 386 ha and LF-1E/PI-27E has approximately 636 ha • difference considered sufficient to warrant inclusion
• fish and wildlife features of significance	2	-3.0	-5.0	• LF-1E has two pike spawning areas; LF-1E/PI-27E has three pike spawning areas and one waterfowl production area • difference considered sufficient to warrant inclusion
• other natural vegetation	3	-3.0	-5.0	• LF-1E has 338 ha; LF-1E/PI-27E has 692 ha • differences considered sufficient to warrant inclusion
• rare species	3	-1.0	-3.0	• LF-1E has low potential impact on both rare plant and animal species; high potential impact on rare plant species with LF-1E/PI-27E; difference considered sufficient to warrant inclusion

TABLE C.22

Major Impact Differences

LF-1E vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-1E	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Site Vicinity** (cont'd)				
- **Air Dispersion/Air Quality**				
• existing and anticipated air quality	6	-3.5	-5.0	• higher constraint for existing air quality for LF-1E/PI-27E • difference considered sufficient to warrant inclusion
• **Community and Regional**				
- **Community and Regional**				
• social stability	8	-4.9	-5.0	• high social stability for both siting options; LF-1E slightly less impacted in terms of stability index, resident displacement and voluntary out-migration • differences considered minor but high factor ranking therefore difference included
- **Community and Regional**				
• social cohesion	6	-4.6	-4.6	• no difference between siting options; difference screened
• community character	8	-4.0	-3.8	• LF-1E has 94% non-industrial land use within 5 km and 98% within 2 km; LF-1E/PI-27E has 97% non-industrial land within 5 km and 77% within 5 km • difference considered minor but high factor rank, therefore difference included
• regional and community economic base	8	+4.5	+5.0	• slightly more positive impacts for LF-1E/PI-27E; more regional jobs created (422 vs. 395) and more additional households (178 vs. 165) • difference considered minor but high factor rank, therefore difference included
• tourism economy	8	-5.0	-5.0	• no difference between options; difference screened

TABLE C.22

Major Impact Differences

LF-1E vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-1E	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Community and Regional** (cont'd)				
- **Community and Regional** (cont'd)				
• tourism operations	6	0.0	-5.0	• no impact anticipated for LF-1E • difference considered sufficient to warrant inclusion
- **Land Use**				
• existing land use	4	-1.7	-3.3	• LF-1E has substantial amounts of industrial lands in the area (6%) and low residential use (2%); LF-1E/PI-27E has 4% industrial lands and 6% residential • difference considered sufficient to warrant inclusion
- **Agricultural Resources**				
• stability of farm population	8	-2.6	-2.6	• no difference between options; difference screened
• stability of agricultural land base	8	-3.4	-2.8	• for LF-1E 53% of land is in large parcels, 39% of land is owned farmland, 62% of area is farmed, 17% of residences are farm residences, 72% of land is agriculturally designated and 99% of land is privately owned; for LF-1E/PI-27E, 51% of land is in large parcels, 27% of land is owned farmland, 51% of area is farmed, 15% of residences are farm residences, 50% of land is agriculturally designated and 97% is in private land ownership difference considered minor but factor highly ranked, therefore difference included
• disruption to the farm economy	8	-1.5	-1.3	• LF-1E has a higher livestock and crop exposure to fugitive emissions and a higher livestock exposure to stack emissions • difference between options is minor but factor is highly ranked therefore difference included

TABLE C.23

Major Risk Differences

LF-9C vs. LF-4N/PI-1N

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-4N/PI-1N	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Transportation**				
• annual province-wide hazard-based spill index of OWMC generated transport	8	-3.3	-3.0	• difference between one spill every 8.5 years for LF-9C and one spill every 9.1 years for LF-4N/PI-1N • difference sufficient to warrant inclusion
• annual province-wide accident involvements of OWMC generated transport	8	-3.2	-1.8	• difference between 1.4 accidents per year for LF-9C and 0.77 accidents per year for LF-4N/PI-1N • difference sufficient to warront inclusion
• transportation risks on local and regional access roads due to accident involvements of OWMC generated transport	10	-4.6	-1.1	• difference between one accident every 1.2 years for LF-9C and one accident every 1.1 years for LF-4N/PI-1N • LF-9C has second highest road user risk index of all siting options • difference sufficient to warrant inclusion
• transportation risks on local and regional access roads due to hazard-based spills of OWMC generated transport	10	-3.9	-0.9	• difference between one spill every 20.4 years for LF-9C and one spill every 34.4 years for LF-4N/PI-1N • difference sufficient to warrant inclusion
• **Air Quality**				
• risk from direct inhalation of emissions - chronic	9	-1.5	-4.1	• LF-4N/PI-1N has higher values for relative population exposure - fugitive and incinerator stack emissions and for relative future population exposure - fugitive and incinerator stack emissions • difference sufficient to warrant inclusion
• risk from direct inhalation of emissions - acute	8	-2.9	-5.0	• LF-4N/PI-1N has higher values for topographic features on or around site, relative existing and future population exposure-upset emissions from incinerator stack and distribution of community facilities • difference sufficient to warrant inclusion

TABLE C.23

Major Risk Differences

LF-9C vs. LF-4N/PI-1N

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-4N/PI-1N	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Air Quality**				
• risk from ingestion of cistern and pond water	6	-1.5	-1.4	• LF-4N/PI-1N has lower relative exposure for incinerator stack emissions while LF-9C has lower relative exposure for fugitive emissions • negligible difference between options; difference screened
• risk from consumption of crops and livestock	5	-5.0	-3.1	• LF-4N/PI-1N has lower values for relative sensitive crop exposures - incinerator stack emissions, relative sensitive livestock exposures - fugitive and incinerator stack emissions, relative future sensitive crop exposures - incinerator stack emissions and relative future sensitive livestock exposure - fugitive and incinerator stack emissions • LF-9C has lower values for relative sensitive crop exposures - fugitive emissions and relative future sensitive crop exposures - fugitive emissions • difference sufficient to warrant inclusion
• **Hydrogeologic Suitability**				
• capability of providing natural containment	10	-1.0	-6.0	• confining layer with LF-9C is uniform and laterally and vertically continuous, resulting in long contaminant breakthrough times; confining layer is thin at both LF-4N and PI-1N resulting in relatively rapid breakthrough times • difference sufficient to warrant inclusion
• ground water use	7	-5.0	-5.0	• no difference between siting options; difference screened
• **Surface Water Suitability**				
• susceptibility of site to flooding	3	-2.3	-3.0	• LF-4N has designated floodplain land (Indian Creek) on-site; LF-9C has no designated floodplain land • negligible difference between options; difference screened

TABLE C.24

Major Impact Differences

LF-9C vs. LF-4N/PI-1N

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-4N/PI-1N	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• Site				
- Residents				
• displacement of residents	9	-1.3	-3.1	• LF-9C has the least number of residents presently living on-site (9) and is potentially least impacted overall; LF-4N/PI-1N has third highest number of residents on-site (34) and is ranked third most impacted overall (IER, 1985a, p.242) • difference sufficient to warrant inclusion
- Community and Recreation Features				
• displacement of historical, community and recreation features	3	0.0	-5.0	• no historical, community and recreation features displaced with LF-9C; LF-4N/PI-1N involves displacement of two significant features • difference sufficient to warrant inclusion
- Land Use				
• planned and proposed land use	7	-5.0	-4.7	• negligible difference between options; difference screened
• land use stability	2	-3.6	-3.0	• LF-9C has moderate proportion of lands under absentee ownership, no land sales and all buildings in good condition (LKA, 1985, Table H.6); (LF-4N/PI-1N has a relatively low number of lands under absentee ownership but no land sales and a high proportion of good quality buildings (LKA, 1985, Table H.6) • negligible difference between options; difference screened
- Agricultural Resources				
• loss of farmland	6	-2.3	-5.0	• LF-9C involves loss of 90 ha Class 1 equivalents; LF-4N/PI-1N involves loss of 264 ha Class 1 equivalents • difference sufficient to warrant inclusion

TABLE C.24

Major Impact Differences

LF-9C vs. LF-4N/PI-1N

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-4N/PI-1N	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• Site (cont'd)				
- Natural Environment				
• rare species	8	-5.0	-3.0	• high potential impact on rare plant and animal species with LF-9C; moderate potential impact on rare plant species with LF-4N/PI-1N (GLAL, 1985a, p.92 and p.104) • difference sufficient to warrant inclusion
• natural vegetation displaced	4	-1.0	-1.0	• no difference between options; difference screened
• potential for occurence of other significant features	6	-1.0	-1.0	• no difference between options; difference screened
• Site Vicinity				
- Residents				
• property value impacts	7	1.2	-3.9	• low level ($435,000) of negative property value impacts for LF-9C; moderately high level ($1,487,000) of negative property value impacts for LF-4N/PI-1N (Clayton, 1985a, pp.25 and 28) • differences sufficient to warrant inclusion
• disruption of use and enjoyment of property and/or day-to-day activities (adjacent to site)	10	-2.4	-4.3	• LF-9C has 40 residents adjacent to site and 15 residents spending most time on properties adjacent to site; LF-4N/PI-1N has 88 residents adjacent to site and 23 residents spending most time on properties adjacent to site • difference sufficient to warrant inclusion
• disruption of use and enjoyment of property and/or day-to-day activities (non-adjacent)	9	-4.8	-5.0	• LF-9C has 272 residents in site vicinity, 25 residents spending most time on properties within 55 dBa noise impact zone and moderate impact with respect to visual intrusion; LF-4N/PI-1N has 759 residents in site vicinity, 9 residents spending most time on properties within 55 dBa noise impact zone and is second most impacted in terms of visual intrusion • relatively minor differences between options but high ranked factor

TABLE C.24

Major Impact Differences

LF-9C vs. LF-4N/PI-1N

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-4N/PI-1N	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Site Vicinity** (cont'd)				
- **Residents**				• therefore, difference considered sufficient to warrant inclusion
- **Community and Recreation Features**				
• disruption of operations of community and recreation features (adjacent to site)	5	-0.0	-2.5	• 0 features located adjacent to LF-9C: one feature (Hunterbrook Farm) located adjacent to LF-4N/PI-1N • difference sufficient to warrant inclusion
• disruption of operations of community and recreation features (site vicinity)	3	0.3	-2.7	• LF-9C has two features in site vicinity; LF-4N/PI-1N has 16 features in site vicinity, 6 sensitive features in site vicinity and one feature within noise impact zone • difference sufficient to warrant inclusion
- **Land Use**				
• existing land use	8	-2.0	-3.3	• LF-9C has moderately low numbers of residences within the site vicinity (15), few commercial uses (7) and no industrial uses; LF-4N/PI-1N has moderately low numbers of residences within the site vicinity (131), few commercial (12) and industrial uses (2) (LKA, 1985, Table H.6) • difference sufficient to warrant inclusion
• planned and proposed land use	7	-4.4	-5.0	• LF-9C has generally agricultural land use designations with official plan policies that are generally protective of agricultural lands and no industrial designations; LF-4N/PI-1N is primarily designated agricultural with some significant residential clusters in the official plan policies that are protective of agricultural lands and no industrial lands (LKA, 1985, Table H.6) • negligible difference between options; difference screened
• provincial policies and plans	2	0.0	-5.0	• no impact on provincial policies and plans with LF-9C; LF-4N/PI-1N may impact both Parkway Belt West Plan and Niagara Escarpment Plan • difference sufficient to warrant inclusion

TABLE C.24

Major Impact Differences

LF-9C vs. LF-4N/PI-1N

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-4N/PI-1N	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Site Vicinity** (cont'd)				
- **Land Use**				
• land use stability	3	-5.0	-1.8	• LF-9C has a low proportion of land under absentee land ownership (11%), land sales (9) and steadily rising land values; LF-4N/PI-1N has a substantial proportion of land under absentee land ownership (76%), several recent land sales (15) and severe fluctuations in land value (LKA, 1985, Table H.6) • difference sufficient to warrant inclusion
- **Agricultural Resources**				
• partial displacement of farms	9	-2.3	-4.4	• one farm affected with LF-9C with average parcel size of 20 ha and 16% of land base lost is owned; five farms affected with LF-4N/PI-1N with average parcel size of 50 ha and 0% of land base lost is owned • difference sufficient to warrant inclusion
• disruption of adjacent farm operations	10	-4.6	-3.4	• LF-9C has six adjacent farms with headquarters and a livestock density of 1.14 animal units/ha; LF-4N/PI-1N has five adjacent farms with headquarters and a livestock density of 0.40 animal units/ha • difference sufficient to warrant inclusion
• disruption of non-adjacent farm operations	9	-5.0	-3.2	• LF-9C has 23 non-adjacent farms with headquarters, 71% non-adjacent vicinity in crops and a livestock density of 2.44 animal units/ha; LF-4N/PI-1N has 16 non-adjacent farms with headquarters, 67% non-adjacent vicinity in crops and a livestock density of 0.45 animal units/ha • difference sufficient to warrant inclusion
- **Natural Environment**				
• rare species	2	-1.0	-3.0	• LF-9C has one rare plant specie (low impact) and three rare animal species (moderate impact); LF-4N/PI-1N has eight rare plant species (moderate impact) and three rare animal species (low impact) (GLAL, 1985a, pp.104 and 114) • difference sufficient to warrant inclusion

TABLE C.24

Major Impact Differences

LF-9C vs. LF-4N/PI-1N

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-4N/PI-1N	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Site Vicinity** (cont'd)				
- **Natural Environment**				
• significant environmental units (SEUs)	4	-1.0	-1.0	• no difference between options; difference screened
• fish and wildlife features of significance	2	-3.0	-1.0	• LF-9C has two significant pike spawning areas; LF-4N/PI-1N has one significant waterfowl staging area • difference sufficient to warrant inclusion
• other natural vegetation	3	-1.0	-1.0	• no difference between options; difference screened
- **Air Dispersion/Air Quality**				
• restraints to dispersion	2	-1.0	-5.0	• no restraints to dispersion with LF-9C; LF-4N/PI-1N has high impact due to local modifications to dispersion climatology, some potential for wind channelling and effects on atmospheric turbulence • difference sufficient to warrant inclusion
• existing and anticipated air quality	6	-2.9	-3.3	• LF-9C has lower estimated effect on air quality-fugitive emissions than LF-4N/PI-1N • negligible difference between options; difference screened
• **Community and Regional**				
- **Community and Regional**				
• social stability	8	-4.2	-3.4	• LF-9C is potentially the third least impacted siting option since it has the highest level of existing stability (along with LF-1E/PI-27E) and has moderate potential for disruption through voluntary out-migration and residential displacement; LF-4N/PI-1N is potentially the least impacted siting option; it has the second lowest level of existing stability and the least potential for disruption through out-migration (IER, 1985a, p.287)

TABLE C.24

Major Impact Differences

LF-9C vs. LF-4N/PI-1N

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-4N/PI-1N	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• Community and Regional (cont'd)				
- Community and Regional				
• social stability (cont'd)				• relatively minor differences between options but high ranked factor • therefore, difference considered sufficient to warrant inclusion
• community character	8	-4.6	-4.8	• LF-9C is potentially the third most impacted siting option since it is potentially most impacted in terms of land use compatiblity and third most impacted in terms of heritage features and visual compatibility; LF-4N/PI-1N is potentially second most impacted siting option in terms of community character because of impacts with regard to compatibility with land use, heritage features and visual compatibility (IER, 1985a, pp.292 and 296) • relatively minor differences between options but high ranked factor • therefore, difference considered sufficient to warrant inclusion
• community and regional economic base	8	+2.4	+2.6	• 356 new jobs and 210 additional households created with LF-9C, 331 new jobs and 249 additional households created with LF-4N/PI-1N • relatively minor differences between options but high ranked factor • therefore, difference considered sufficient to warrant inclusion
• municipal finance	6	+5.0	+0.2	• LF-9C most positively impacted siting option since impact of payments in lieu of taxes is large compared to municipal tax base and financial impacts on operating costs of area municipality are less because of lower service levels; impacts of payments in lieu of taxes much less for LF-4N/PI-1N because of municipal tax levy situation; also, LF-4N/PI-1N requires two sites resulting in greater reduced property taxes due to relative property value impacts; LF-4N has potential siting conflict with Region of Halton site selection process (Clayton, 1985b, p.91) • difference sufficient to warrant inclusion
- Land Use				
• existing land use	4	-3.3	-5.0	• LF-9C is 98% rural/vacant with limited residential lands and no industrial land use; LF-4N/PI-1N is 96% rural/vacant with some significant residential areas but no industrial lands (LKA, 1985, Table H.6)

TABLE C.24

Major Impact Differences

LF-9C vs. LF-4N/PI-1N

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-4N/PI-1N	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• Community and Regional (cont'd)				
- Land Use				
• existing land use (cont'd)				• difference sufficient to warrant inclusion
• planned and proposed land use	4	-3.8	-5.0	• LF-9C has predominantly agricultural land use designations with minor residential clusters and no industrial lands; LF-4N/PI-1N has predominantly agricultural land use designations with some residential clusters and no industrial lands (LKA, 1985, Table H.6) • difference sufficient to warrant inclusion
• provincial plans and policies	1	0.0	-5.0	• no impact on provincial plans and policies with LF-9C; LF-4N/PI-1N may impact both Parkway Belt West Plan and Niagara Escarpment Plan • difference sufficient to warrant inclusion
- Agricultural Resources				
• stability of farm population	9	-5.0	-4.4	• LF-9C has 75% operators under age 55 and 60% of operators are full-time; LF-4N/PI-1N has 62% operators under age 55 and 56% of operators are full-time • differences between options are minimal, however high factor rank • therefore, difference sufficient to warrant inclusion
• stability of agricultural land base	8	-5.0	-4.1	• LF-9C has 76% owned farmland with about 94% of total area farmed and 91% of the land in large parcels; LF-4N/PI-1N has 32% owned farmland with about 89% of total area farmed and 82% of land in large parcels • relatively minor differences between options but high ranked factor • therefore, difference sufficient to warrant inclusion
• disruption to farm economy	8	-4.9	-3.5	• LF-9C has a gross farm revenue of $8.6 million (1981); LF-4N/PI-1N has a gross farm revenue of $6.4 million (1981) • difference sufficient to warrant inclusion

TABLE C.24

Major Impact Differences

LF-9C vs. LF-4N/PI-1N

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-4N/PI-1N	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• Access Roads				
- Residents				
• disruption of day-to-day activities and/or the use and enjoyment of property (adjacent)	8	-3.9	-2.1	• LF-9C has the second highest number of adjacent residents (775) and the second highest number of residents potentially sensitive to increased traffic (269); LF-4N/PI-1N has the fourth highest number of adjacent residents (435) and the third highest number of residents potentially sensitive to increased traffic (139) • difference sufficient to warrant inclusion
• disruption of day-to-day activities and/or the use and enjoyment of property (vicinity)	7	-4.5	-1.2	• LF-9C has the second highest number of residents in the access road vicinity (1,716) and in the noise impact zone (986); LF-4N/PI-1N has the fourth highest number of residents in the access road vicinity (295) and in the noise impact zone (358) • difference sufficient to warrant inclusion
- Community and Recreation Features				
• disruption of operations of community and recreation features (adjacent)	2	-3.5	-4.1	• LF-9C has 14 features and six sensitive features adjacent to the access route; LF-4N/PI-1N has 16 features and seven sensitive features adjacent to the access route • negligible difference between options; difference screened
• disruption of operations of community and recreation features (vicinity)	1	-3.4	-4.6	• LF-9C has the fourth highest number of features (11) and the second highest number of sensitive features (6) in the access road vicinity as well as the third highest number of features (17) and sensitive features (7) in the noise impact zone; LF-4N/PI-1N has the third highest number of features (12) and sensitive features (5) in the access route vicinity as well as the second highest number of features (20) and the highest number of sensitive features (14) in the noise impact zone (IER, 1985a, p.282) • difference sufficient to warrant inclusion

TABLE C.24

Major Impact Differences

LF-9C vs. LF-4N/PI-1N

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-4N/PI-1N	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Access Roads** (cont'd)				
- **Land Use**				
• existing land use	4	-5.0	-3.3	• LF-9C has the second highest number of residences (750) and commercial facilities (51) of all siting options with a high proportion of residential land use; LF-4N/PI-1N has a moderate number of residences (475) and commercial facilities (37) with a high proportion of residential land use (LKA, 1985, Table H.6) • difference sufficient to warrant inclusion
• planned and proposed land use	4	-5.0	-4.9	• the access route to LF-9C travels through rural/agricultural areas with substantial amounts of residentially designated land and policies which protect agricultural lands; the access routes to LF-4N/PI-1N travel through rural/agricultural areas with substantial amounts of residentially designated land and policies which protect agricultural lands; greater number of unapproved development proposals near Milton than Vineland (LKA, 1985, Table H.6) • negligible difference between options; difference screened
- **Agricultural Resources**				
• disruption to farm traffic and cattle crossings	8	-1.5	-3.0	• impacts on local roads negligible for LF-9C but has agricultural vehicle impact index of 36,400 and 35,300 customer stops on regional roads; LF-4N/PI-1N has agricultural vehicle impact indices of 10,000 and 10,600 for local and regional roads, respectively and 5,500 and 6,000 customer stops for local and regional roads, respectively • difference sufficient to warrant inclusion
- **Natural Environment**				
• fish communities	4	-3.0	-5.0	• access route to LF-9C crosses 109.1 km and 27.2 km of regionally and locally significant fishery, respectively; LF-4N/PI-1N access routes cross 145.6 km and 179.5 km of regionally and locally significant fishery, respectively • difference sufficient to warrant inclusion

TABLE C.25

Major Risk Differences

LF-4N/PI-1N vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-4N/PI-1N	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• Transportation				
• annual province-wide hazard-based spill index of OWMC generated transport	8	-3.0	-5.0	• difference between 1 spill every 9.1 years for LF-4N/PI-1N and 1 spill every 5.5 years for LF-1E/PI-27E • difference sufficient to warrant inclusion
• annual province-wide accident involvements of OWMC generated transport	8	-1.8	-5.0	• difference between 0.77 accidents per year for LF-4N/PI-1N and 2.1 accidents per year for LF-1E/PI-27E • difference sufficient to warrant inclusion
• transportation risks on local and regional access roads due to accident involvements of OWMC generated transport	10	-1.1	-0.2	• difference between 1 accident every 1.1 years for LF-4N/PI-1N and 1 accident every 7.1 years for LF-1E/PI-27E • difference sufficient to warrant inclusion
• Air Quality				
• risk from direct inhalation of emissions - chronic	9	-4.1	-5.0	• LF-4N/PI-1N has lower values for relative population exposure - fugitive and incinerator stack emissions and relative future population exposure - fugitive emissions; LF-1E/PI-27E in close proximity to more heavily populated area • relatively minor difference between options, but high ranked factor • therefore, difference sufficient to warrant inclusion
• risk from direct inhalation of emissions - acute	8	-5.0	-4.1	• LF-1E/PI-27E has lower values for relative existing and future population exposure - upset emissions from low elevation sources, distribution of community facilities and topographic features on or around site; LF-4N/PI-1N has lower values for relative existing and future population exposure - upset emissions from incinerator stack • relatively minor difference between options, but high ranked factor • therefore, difference sufficient to warrant inclusion

TABLE C.25

Major Risk Differences

LF-4N/PI-1N vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-4N/PI-1N	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Air Quality** (cont'd)				
• risk from consumption of crops and livestock	5	-3.1	-1.3	• LF-1E/PI-27E has lower values all indicators for this factor • difference sufficient to warrant inclusion
• **Hydrogeologic Suitability**				
• capability of providing natural containment	10	-6.0	-5.0	• confining layer is thin at both LF-4N and PI-1N resulting in relatively rapid contaminant breakthrough times; confining layer varies under both LF-1E and PI-27E as a result of locally occurring geologic features, breakthrough times are anticipated to vary locally • minor difference in factor suitability levels, but highly ranked factor; more precise differences between siting options not reflected in factor suitability levels • therefore, difference considered sufficient to warrant inclusion
• ground water use	7	-5.0	-5.0	• no difference between siting options; difference screened
• **Surface Water Suitability**				
• susceptibility of site to flooding	3	-3.0	-3.0	• LF-4N has designated floodplain land (Indian Creek) on site; LF-1E/PI-27E has no designated floodplain land • recognized that floodplain lands can be avoided • minor difference in factor suitability levels and low ranked factor • therefore, differences between options considered negligible; difference screened
• potential for surface water use interference	7	-2.5	-0.8	• third highest downstream water use index associated with LF-4N/PI-1N (36) (along with LF-9C); LF-1E/PI-27E has second lowest downstream water use index (15) • difference sufficient to warrant inclusion

TABLE C.26

Major Impact Differences

LF-4N/PI-1N vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-4N/PI-1N	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• Site				
- Residents				
• displacement of residents	9	-3.1	-5.0	• LF-4N/PI-1N has the third highest number of residents on-site (34) and is ranked third most impacted overall; LF-1E/PI-27E has the second highest number of residents on-site (42) and is the second most impacted siting option overall (IER, 1985a, pp. 238 & 242) • difference sufficient to warrant inclusion
- Businesses				
• displacement of businesses	4	-2.2	-5.0	• LF-4N/PI-1N involves displacement of 5 businesses with 14 employees and $709,000 in sales; LF-1E/PI-27E involves displacement of 7 businesses with 32 employees and $2.6 million in sales • difference sufficient to warrant inclusion
- Community and Recreation Features				
• displacement of historical, community and recreation features	3	-5.0	0.0	• no historical, community and recreation features displaced with LF-1E/PI-27E; LF-4N/PI-1N involves displacement of 2 significant features • difference sufficient to warrant inclusion
- Land Use				
• existing land use	6	-2.6	-5.0	• LF-4N/PI-1N has a moderate number of residences on-site (11) and no commercial or industrial facilities; LF-1E/PI-27E has a high number of residences on-site (15) and 1 commercial and 1 industrial facility (LKA, 1985, Table B.6) • difference sufficient to warrant inclusion

TABLE C.26

Major Impact Differences

LF-4N/PI-1N vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-4N/PI-1N	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Site**				
• planned and proposed land use	7	-4.7	-2.5	• LF-4N/PI-1N has generally agricultural land use designations which are partially offset by the sanitary landfill designation on LF-4N, policies and zoning are protective of agricultural land; LF-1E/PI-27E has industrial designations on PI-27E which is compatible with proposed facilities (LKA, 1985, Table H.6) • difference sufficient to warrant inclusion
• land use stability	2	-3.0	-2.5	• LF-4N/PI-1N has a relatively low number of lands under absentee ownership, but no land sales and a high proportion of good quality buildings; LF-1E/PI-27E has a moderate proportion of its lands under absentee ownership, some land sales and a relatively low percentage of buildings in good condition (LKA, 1985, Table H.6) • negligible difference between options; difference screened
- **Agricultural Resources**				
• loss of farmland	6	-5.0	-1.7	• LF-4N/PI-1N involves loss of 264 ha Class 1 equivalent; LF-1E/PI-27E involves loss of 91 ha Class 1 equivalent • difference sufficient to warrant inclusion
- **Natural Environment**				
• rare species	8	-3.0	-5.0	• moderate potential impact on rare plant species with LF-4N/PI-1N; high potential impact on rare plant species with LF-1E/PI-27E (GLAL, 1985a, pp. 87, 88 & 92) • difference sufficient to warrant inclusion
• natural vegetation displaced	4	-1.0	-3.0	• approximately 36 ha of natural vegetation displaced with LF-4N/PI-1N; approximately 67 ha of natural vegetation displaced with LF-1E/PI-27E • difference sufficient to warrant inclusion

TABLE C.26

Major Impact Differences

LF-4N/PI-1N vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-4N/PI-1N	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• Site				
• potential for occurrence of other significant features	6	-1.0	-5.0	• high potential on LF-1E and PI-27E to find additional rare species; low potential for finding additional significant features on LF-4N and PI-1N (GLAL, 1985a, pp. 87-88) • difference sufficient to warrant inclusion
• Site Vicinity				
- Residents				
• property value impacts	7	-3.9	-2.8	• moderately high level ($1,487,000) of negative property value impacts for LF-4N/PI-1N; moderate level ($1,050,000) of negative property value impacts for LF-1E/PI-27E (Clayton, 1985a, pp. 27-28) • difference sufficient to warrant inclusion
• disruption of use and enjoyment of property and/or day-to-day activities (adjacent to site)	10	-4.3	-2.1	• LF-4N/PI-1N has 85 residents adjacent to site and 23 residents spending most time on properties adjacent to site; LF-1E/PI-27E has 42 residents adjacent to site and 11 residents spending most time on properties adjacent to site • difference sufficient to warrant inclusion
• disruption of use and enjoyment of property and/or day-to-day activities (non-adjacent)	9	-5.0	-3.6	• LF-4N/PI-1N has 759 residents in site vicinity, 9 residents spending most time on properties within 55 dBa noise impact zone and is second most impacted in terms of visual intrusion; LF-1E/PI-27E has 350 residents in site vicinity, 9 residents spending most time on properties within 55 dBa noise impact zone and low impact with respect to visual intrusion; LF-1E/PI-27E has fewer residents within both daytime and nighttime noise impact zones (IER, 1985a, pp. 247 & 251) • difference sufficient to warrant inclusion

TABLE C.26

Major Impact Differences

LF-4N/PI-1N vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-4N/PI-1N	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Site Vicinity**				
- **Businesses**				
• business activities negatively affected by the presence of OWMC facilities	4	-2.6	-3.3	• 14 businesses with 39 employees and $1,473,000 in sales negatively affected with LF-4N/PI-1N; 12 businesses with 69 employees and $2,192,000 in sales negatively affected with LF-1E/PI-27E • negligible difference between options; difference screened
• business activities positively affected by the presence of OWMC facilities	6	+0.4	+5.0	• 1 business with 125 employees and $7,500,000 in sales positively affected with LF-4N/PI-1N; 12 businesses with 1,450 employees and $81,928,000 in sales positively affected with LF-1E/PI-27E • difference sufficient to warrant inclusion
- **Community and Recreation Features**				
• disruption of operations of community and recreation features (adjacent to site)	5	-2.5	-5.0	• 1 feature (Hunterbrook Farm) located adjacent to LF-4N/PI-1N; 2 features (Arpad Hungarian Cultural Centre and Grassybrook Park) located adjacent to LF-1E/PI-27E • difference sufficient to warrant inclusion
• disruption of operations of community and recreation features (site vicinity)	3	-2.7	-4.0	• LF-4N/PI-1N has 16 features in site vicinity, 6 sensitive features in site vicinity and 1 feature within noise impact zone; LF-1E/PI-27E has 20 features in site vicinity, 6 sensitive features in site vicinity and 1 sensitive feature within noise impact zone • difference sufficient to warrant inclusion
- **Land Use**				
• existing land use	8	-3.3	-3.6	• LF-4N/PI-1N has moderately low numbers of residences within the site vicinity (131), few commercial (13) and industrial uses (2); LF-1E/PI-27E has a high number of residences within the site vicinity (222), 15 commercial uses and 11 industrial uses (LKA, 1985, Table H.6) • relatively minor difference between options, but high factor rank • therefore, differences sufficient to warrant inclusion

TABLE C.26

Major Impact Differences

LF-4N/PI-1N vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-4N/PI-1N	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Site Vicinity**				
• planned and proposed land use	7	-5.0	-2.7	• LF-4N/PI-1N is primarily designated agricultural with some significant residential clusters with official plan policies that are protective of agricultural lanis and no industrial lands; LF-1E/PI-27E has generally agricultural land use designations with substantial amounts of industrial designations, official plan policies are protective of agricultural lands, but also promote industrial development (LKA, 1985, Table H.c) • difference sufficient to warrant inclusion
• land use stability	3	-1.9	-3.6	• LF-4N/PI-1N has a substantial proportion of land under absentee land ownership (76%), several recent land sales (15) and severe fluctuations in land value; LF-1E/PI-27E has a moderate proportion of land under absentee land ownership (44%), relatively few land sales (10) and no discernible trends in land sales (LKA, 1985, Table H.6) • difference sufficient to warrant inclusion
• provincial policies and plans	2	-5.0	0.0	• LF-4N/PI-1N may impact both Parkway Belt West Plan and Niagara Escarpment Plan; no impact on provincial policies and plans with LF-1E/PI-27E • difference sufficient to warrant inclusion
- **Agricultural Resources**				
• partial displacement of farms	9	-4.4	-3.6	• 5 farms affected with LF-4N/PI-1N with average parcel size of 50 ha and 0% land base lost is owned; 2 farms affected with LF-1E/PI-27E with average parcel size of 13 ha and 25% land base lost is rented • relatively minor differences between options, but high ranked factor • therefore, difference considered sufficient to warrant inclusion
• disruption of adjacent farm operations	10	-3.4	-2.8	• LF-4N/PI-1N has 5 adjacent farms with headquarters, 8 operators with owned land and a livestock density of 0.40 animal units/ha; LF-1E/PI-27E has 4 adjacent farms with headquarters, 7 operators with owned land and a livestock density of 0.27 animal units/ha • relatively minor differences between options, but high ranked factor • therefore, difference considered sufficient to warrant inclusion

TABLE C.26

Major Impact Differences

LF-4N/PI-1N vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-4N/PI-1N	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Site Vicinity**				
• disruption of non-adjacent farm operations	9	-3.2	-2.4	• LF-4N/PI-1N has 16 non-adjacent farms with headquarters, 67% non-adjacent vicinity in crops and a livestock density of 0.45 animal units/ha; LF-1E/PI-27E has 23 non-adjacent farms with headquarters, 22% non-adjacent vicinity in crops and a livestock density of 0.25 animal units/ha • relatively minor differences between options, but high ranked factor • therefore, difference considered sufficient to warrant inclusion
- **Natural Environment**				
• significant environmental units (SEUs)	4	-1.0	-5.0	• approximately 140 ha of SEU potentially impacted with LF-4N/PI-1N; approximately 636 ha of SEU potentially impacted with LF-1E/PI-27E • difference sufficient to warrant inclusion
• fish and wildlife features of significance	2	-1.0	-5.0	• LF-4N/PI-1N has one significant waterfowl staging area; LF-1E/PI-27E has 4 significant features including 3 pike spawning areas and a waterfowl production area • difference sufficient to warrant inclusion
• other natural vegetation	3	-1.0	-5.0	• LF-4N/PI-1N has approximately 245 ha of other natural vegetation; LF-1E/PI-27E has approximately 692 ha of other natural vegetation • difference sufficient to warrant inclusion
• rare species	2	-3.0	-3.0	• no difference between siting options; difference screened
- **Air Dispersion/Air Quality**				
• restraints to dispersion	2	-5.0	-1.0	• LF-4N/PI-1N has high impact due to local modifications to dispersion climatology, some potential for wind channelling and effects on atmospheric turbulence; no restraints to dispersion with LF-1E/PI-27E • difference sufficient to warrant inclusion

TABLE C.26

Major Impact Differences

LF-4N/PI-1N vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-4N/PI-1N	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Site Vicinity**				
• existing and anticipated air quality	6	-3.3	-5.0	• LF-4N/PI-1N has lower values for existing and short-term air quality than LF-1E/PI-27E; existence of polluting industries in vicinity of LF-1E/PI-27E • difference sufficient to warrant inclusion
• **Community and Regional**				
- **Community and Regional**				
• social stability	8	-3.4	-5.0	• LF-4N/PI-1N is potentially the least impacted siting option since it has the second lowest level of existing stability and has the least potential for disruption through out-migration; LF-1E/PI-27E is potentially the most impacted siting option since it has the highest level of existing stability (along with LF-9C) and is third most disrupted through industry out-migration (IER, 1985a, pp. 283 & 287) • difference sufficient to warrant inclusion
• social cohesion	6	-2.2	-4.6	• LF-4N/PI-1N is second least impacted siting option in terms of social cohesion due to second lowest potential for disruption through resident displacement and lowest potential for industry out-migration; LF-1E/PI-27E is second most impacted siting option in terms of social cohesion through resident displacement and resident out-migration (IER, 1985a, p. 291) • difference sufficient to warrant inclusion
• community character	8	-4.8	-3.8	• LF-4N/PI-1N is potentially second most impacted siting option in terms of community character because of impacts with regard to compatibility with land use, heritage features and visual compatibility; LF-1E/PI-27E is potentially the least impacted siting option since it is the most compatible with land use and has the least potential impact in terms of heritage features and the second least impact in terms of visual compatibility (IER, 1985a, pp. 292 & 297 • difference sufficient to warrant inclusion

TABLE C.26

Major Impact Differences

LF-4N/PI-1N vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-4N/PI-1N	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• Community and Regional				
• community and regional economic base	8	+2.6	+5.0	• 331 new jobs and 249 additional households created with LF-4N/PI-1N; 422 new jobs and 303 additional households created with LF-1E/PI-27E • difference sufficient to warrant inclusion
• tourism economy	8	-1.0	-5.0	• LF-4N/PI-1N second least impacted siting option (along with LF-4N/PI-13N) in terms of potential impacts on tourism economy; LF-1E/PI-27E potentially most impacted siting option in terms of potential impacts on tourism economy • difference sufficient to warrant inclusion
• tourism operations	6	-1.7	-5.0	• LF-4N/PI-1N second least impacted siting option (along with LF-4N/PI-13N) in terms of potential impacts on tourism operations; LF-1E/PI-27E potentially most impacted siting option in terms of potential impacts on tourism operations • difference sufficient to warrant inclusion
- Land Use				
• existing land use	4	-5.0	-3.3	• LF-4N/PI-1N is 96% rural/vacant with some significant residential areas, but no industrial lands; LF-1E/PI-27E is 90% rural/vacant with significant amounts of residential land use and substantial industrial lands (LKA, 1985, Table H.6) • difference sufficient to warrant inclusion
• planned and proposed land use	4	-5.0	-2.6	• LF-4N/PI-1N has predominantly agricultural land use designations with some residential clusters and no industrial lands; LF-1E/PI-27E has generally agricultural land use designations with substantial amounts of industrial designations, considerable heavy industrial lands with official plan policies encouraging industrial development (LKA, 1985, Table H.6) • difference sufficient to warrant inclusion

TABLE C.26

Major Impact Differences

LF-4W/PI-1W vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-4W/PI-1W	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Community and Regional**				
• provincial policies and plans	1	-5.0	0.0	• LF-4W/PI-1W may impact both Parkway Belt West Plan and Niagara Escarpment Plan; no impact on provincial plans and policies with LF-1E/PI-27E • difference sufficient to warrant inclusion
- **Agricultural Resources**				
• stability of farm population	9	-4.4	-2.6	• 56% of operators are full-time with LF-4W/PI-1W; 16% of operators are full-time with LF-1E/PI-27E • difference sufficient to warrant inclusion
• stability of agricultural land base	8	-4.1	-2.8	• LF-4W/PI-1W has 32% owned farmland with about 89% of total area farmed and 82% of land in large parcels; LF-1E/PI-27E has 27% owned farmland with about 51% of total area farmed and 51% of land in large parcels • difference sufficient to warrant inclusion
• disruption to farm economy	8	-3.5	-1.3	• LF-4W/PI-1W has a gross farm revenue of $6.4 million (1981); LF-1E/PI-27E has a gross farm revenue of $2.5 million (1981) • difference sufficient to warrant inclusion
• **Access Roads**				
- **Residents**				
• disruption of day-to-day activities and/or the use and enjoyment of property (adjacent)	8	-2.1	-0.1	• LF-4W/PI-1W has the fourth highest number of adjacent residents (435) and the third highest number of residents potentially sensitive to increased traffic (139); LF-1E/PI-27E has the lowest number of adjacent residents (9) and the lowest number of residents potentially sensitive to the increased traffic (2) • difference sufficient to warrant inclusion

TABLE C.26

Major Impact Differences

LF-4N/PI-1N vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-4N/PI-1N	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• Access Roads				
- Community and Recreation Features				
• disruption of operations of community and recreation features (adjacent)	2	-4.1	-0.1	• LF-4N/PI-1N has 16 features and 7 sensitive features adjacent to the access route; LF-1E/PI-27E has 1 feature adjacent to access route • difference sufficient to warrant inclusion
• disruption of operations of community and recreation features (vicinity)	1	-4.1	-1.4	• LF-4N/PI-1N has the third highest number of features (12) and sensitive features (5) in the access route vicinity, as well as the second highest number of features (20) and highest number of sensitive features (14) in the noise impact zone; LF-1E/PI-27E has the fewest features in the access route vicinity (2) and the fewest features (1) and sensitive features (1) in the noise impact zone (along with LF-1E) • difference sufficient to warrant inclusion
- Land Use				
• existing land use	4	-3.3	-1.0	• LF-4N/PI-1N has a moderate number of residences (471) and commercial facilities (37) with a high proportion of residential land use; LF-1E/PI-27E has few residences (5) and commercial facilities (2) and no residential land uses (LKA, 1985, Table H.6) • difference sufficient to warrant inclusion
• planned and proposed land use	4	-4.9	-0.6	• the access routes to LF-4N/PI-1N travel through rural/agricultural areas with substantial amounts of residentially designated land and policies which protect agricultural lands; the access routes to LF-1E/PI-27E are primarily rural/vacant designations with no residential designations (LKA, 1985, Table H.6) • difference sufficient to warrant inclusion

TABLE C.26

Major Impact Differences

LF-4N/PI-1N vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-4N/PI-1N	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• Access Roads				
- Agricultural Resources				
• disruption to farm traffic and cattle crossings	8	-3.0	0.0	• agricultural vehicle impact index is moderately high for local roads and moderately low for regional roads, moderate number of customer/service stops on all roads for LF-4N/PI-1N; LF-1E/PI-27E has negligible disruption along either local or regional roads • difference sufficient to warrant inclusion
- Natural Environment				
• fish communities	4	-5.0	-1.0	• LF-4N/PI-1N access routes cross 145.6 km and 179.5 km of regionally and locally significant fishery, respectively; LF-1E/PI-27E access routes cross 0 km of significant fishery • difference sufficient to warrant inclusion

TABLE C.27

Major Risk Differences

LF-9C vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Transportation**				
• annual province-wide hazard-based spill index of OWMC generated transport	8	-3.3	-5.0	• difference between 1 spill every 8.5 years for LF-9C and 1 spill every 5.5 years for LF-1E/PI-27E • difference sufficient to warrant inclusion
• annual province-wide accident involvements of OWMC generated transport	8	-3.2	-5.0	• difference between 1.4 accidents per year for LF-9C and 2.1 accidents per year for LF-1E/PI-27E • difference sufficient to warrant inclusion
• transportation risks on local and regional access roads due to accident involvements of OWMC generated transport	10	-4.6	-0.2	• difference between 1 accident every 1.2 years for LF-9C and 1 accident every 7.1 years for LF-1E/PI-27E • difference sufficient to warrant inclusion
• transportation risks on local and regional access roads due to hazard-based spills of OWMC generated transport	10	-3.9	-0.2	• difference between 1 spill every 20.4 years for LF-9C and 1 spill every 277.3 years for LF-1E/PI-27E • difference sufficient to warrant inclusion
• **Air Quality**				
• risk from direct inhalation of emissions - chronic	9	-1.5	-5.0	• LF-9C has lower values for relative existing and future population exposure - fugitive and incinerator stack emissions; LF-1E/PI-27E in proximity to more heavily populated area • difference sufficient to warrant inclusion
• risk from direct inhalation of emissions - acute	8	-2.9	-4.1	• LF-9C has lower values for relative existing and future population exposure - upset emissions from incinerator stack and distribution of community facilities • difference sufficient to warrant inclusion

TABLE C.27

Major Risk Differences

LF-9C vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Air Quality**				
• risk from ingestion of cistern and pond water	6	-1.5	-1.0	• LF-1E/PI-27E has lower values for relative exposure from cistern pond water - fugitive emissions and incinerator stack emissions • negligible difference between options; difference screened
• risk from consumption of crops and livestock	5	-5.0	-1.3	• LF-1E/PI-27E has lower values for all indicators for this factor; LF-9C located in rural/agricultural area • difference sufficient to warrant inclusion
• **Hydrogeologic Suitability**				
• capability of providing natural containment	10	-1.0	-5.0	• confining layer with LF-9C is uniform and laterally and vertically continuous, resulting in long breakthrough times; confining layer varies under both LF-1E and PI-27E as a result of locally occurring geologic features, sand layers could be present within confining layer under both sites, breakthrough times are anticipated to vary locally • difference sufficient to warrant inclusion
• ground water use	7	-5.0	-5.0	• no difference between siting options; difference screened
• **Surface Water Suitability**				
• potential for surface water use interference	7	-2.5	-0.8	• downstream water use index 36 for LF-9C; downstream water use index 15 for LF-1E/PI-27E • difference sufficient to warrant inclusion

TABLE C.28

Major Impact Differences

LF-9C vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• Site				
- Residents				
• displacement of residents	9	-1.3	-5.0	• LF-9C has the least number of residents presently living on site (9) and is potentially least impacted overall; LF-1E/PI-27E has the second highest number of residents on-site (42) and is the second most impacted siting option overall (IER, 1985a, pp. 238 and 242) • difference sufficient to warrant inclusion
- Businesses				
• displacement of businesses	4	0.0	-5.0	• no businesses displaced with LF-9C; LF-1E/PI-27E involves displacement of 7 businesses with 32 employees and $2.6 million in sales • difference sufficient to warrant inclusion
- Land Use				
• existing land use	6	-1.2	-5.0	• LF-9C has the fewest number of residences on-site (3) and no commercial or industrial facilities; LF-1E/PI-27E has a high number of residences on-site (15) and one commercial and one industrial facility (LKA, 1985, Table H.6) • difference sufficient to warrant inclusion
• planned and proposed land use	7	-5.0	-2.5	• LF-9C has generally agricultural land use designations with protective policies for agriculture; LF-1E/PI-27E has industrial designation on PI-27E which is compatible with proposed facilities (LKA, 1985, Table H.6) • difference sufficient to warrant inclusion
• land use stability	2	-3.6	-2.5	• LF-9C has moderate proportion of lands under absentee ownership, no land sales and all buildings in good condition; LF-1E/PI-27E has a moderate proportion of its lands under absentee ownership, some land sales and a relatively low percentage of buildings in good condition (LKA, 1985, Table H.6) • difference sufficient to warrant inclusion

TABLE C.28

Major Impact Differences

LF-9C vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Site**				
– **Agricultural Resources**				
• loss of farmland	6	-2.3	-1.7	• LF-9C involves displacement of 90 ha. Class 1 equivalents; LF-1E/PI-27E involves displacement of 91 ha. Class 1 equivalents (Ecologistics, 1985, p.130) • negligible difference between options; difference screened
– **Natural Environment**				
• rare species	8	-5.0	-5.0	• no difference between siting options; difference screened
• natural vegetation displaced	4	-1.0	-5.0	• approximately 23 ha of natural vegetation displaced with LF-9C; approximately 67 ha of natural vegetation displaced with LF-1E/PI-27E • difference sufficient to warrant inclusion
• potential for occurrence of other significant features	6	-1.0	-3.0	• high potential on LF-1E and PI-27E to find additional rare species; low potential for finding additional significant features on LF-9C (GLAL, 1985a, p. 88) • difference sufficient to warrant inclusion
• **Site Vicinity**				
– **Residents**				
• property value impacts	7	-1.2	-2.8	• LF-9C has a low level of negative property value impacts within site vicinity ($435,000.); LF-1E/PI-27E has a moderate degree of negative property value impacts within the site vicinity ($1,050,000.) (Clayton, 1985a, pp.25 and 27) • difference sufficient to warrant inclusion

TABLE C.28

Major Impact Differences

LF-9C vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Site Vicinity**				
• disruption of use and enjoyment of property and/or day-to-day activities (adjacent to site)	10	-2.4	-2.1	• LF-9C has 40 residents adjacent to site and 15 residents spending most time on properties adjacent to site; LF-1E/PI-27E has 42 residents adjacent to site and 11 residents spending most time on property adjacent to site • relatively minor difference between options, but high ranked factor • therefore, difference considered sufficient to warrant inclusion
• disruption of use and enjoyment of property and/or day-to-day activities (non-adjacent)	9	-4.8	-3.6	• LF-9C has 272 residents in site vicinity, 25 residents spending most time on properties within 55 dBa noise impact zone and moderate impact with respect to visual intrusion; LF-1E/PI-27E has 850 residents in site vicinity, 9 residents spending most time on properties within 55 dBa noise impact zone and low impact with respect to visual intrusion; LF-1E/PI-27E has fewer residents within both daytime and nighttime noise impact zones • difference sufficient to warrant inclusion
- **Businesses**				
• business activities negatively affected by the presence of OWMC facilities	4	-0.7	-3.3	• 4 businesses with 9 employees and $355,000 in sales negatively affected with LF-9C; 12 businesses with 69 employees and $2,192,000 in sales negatively affected with LF-1E/PI-27E • difference sufficient to warrant inclusion
• business activities positively affected by the presence of OWMC facilities	5	+0.1	+5.0	• 1 business with 3 employees and $68,000 in sales positively affected with LF-9C; 12 businesses with 1,450 employees and $81,928,000 in sales positively affected with LF-1E/PI-27E • difference sufficient to warrant inclusion

TABLE C.28

Major Impact Differences

LF-9C vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Site Vicinity**				
- **Community and Recreation Features**				
• disruption of operations of community and recreation features (adjacent to site)	5	0.0	-5.0	• no features located adjacent to LF-9C; 2 features (Arpad Hungarian Cultural Centre and Grassybrook Park) located adjacent to LF-1E/PI-27E • difference sufficient to warrant inclusion
• disruption of operations of community and recreation features (site vicinity)	3	-0.3	-4.0	• LF-9C has 2 features in site vicinity; LF-1E/PI-27E has 20 features in site vicinity, 6 sensitive features in site vicinity and 1 sensitive feature within noise impact zone • difference sufficient to warrant inclusion
- **Land Use**				
• existing land use	8	-2.0	-3.6	• LF-9C has moderately low numbers of residences within the site vicinity (75), few commercial uses (7) and no industrial uses; LF-1E/PI-27E has a high number of residences within the site vicinity (222), 15 commercial uses and 11 industrial uses (LKA, 1985, Table H.6) • difference sufficient to warrant inclusion
• planned and proposed land use	7	-4.4	-2.7	• LF-9C has generally agricultural land use designations with official plan policies that are generally protective of agricultural lands and no industrial designations; LF-1E/PI-27E has generally agricultural land use designations with substantial amount of industrial designations, official plan policies are protective of agricultural lands, but also promote industrial development (LKA, 1985, Table H-6) • difference sufficient to warrant inclusion
• land use stability	3	-5.0	-3.6	• LF-9C has a low proportion of land under absentee land ownership (11%), few land sales (9) and steadily rising land values; LF-1E/PI-27E has a moderate proportion of lands under absentee land ownership (44%), relatively few land sales (10) and no discernible trend in land values (LKA, 1985, Table H-6) • difference sufficient to warrant inclusion

TABLE C.28

Major Impact Differences

LF-9C vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Site Vicinity**				
- **Agricultural Resources**				
• partial displacement of farms	9	-2.3	-3.6	• 1 farm affected with LF-9C with average parcel size of 20 ha and 16% of land base lost is owned; 2 farms affected with LF-1E/PI-27E with average parcel size of 13 ha and 25% land base is rented • difference sufficient to warrant inclusion
• disruption of adjacent farm operations	10	-4.6	-2.8	• LF-9C has 6 adjacent farms with headquarters, 8 operators with owned land and a livestock density of 1.14 animal units/ha; LF-1E/PI-27E has 4 adjacent farms with headquarters, 7 operators with owned land and a livestock density of 0.27 animal units/ha • difference sufficient to warrant inclusion
• disruption of non-adjacent farm operations	9	-5.0	-2.4	• LF-9C has 71% non-adjacent vicinity in crops and a livestock density of 2.44 animal units/ha; LF-1E/PI-27E has 22% non-adjacent vicinity in crops and a livestock density of 0.25 animal units/ha • difference sufficient to warrant inclusion
- **Natural Environment**				
• significant environmental units (SEUs)	4	-1.0	-5.0	• approximately 145 ha of SEU potentially impacted with LF-9C; approximately 636 ha of SEU potentially impacted with LF-1E/PI-27E • difference sufficient to warrant inclusion
• fish and wildlife features of significance	2	-3.0	-5.0	• LF-9C has 2 significant pike spawning areas; LF-1E/PI-27E has 4 significant features including 3 pike spawning areas and a waterfowl production area • difference sufficient to warrant inclusion

TABLE C.28

Major Impact Differences

LF-9C vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• Site Vicinity				
• other natural vegetation	3	-1.0	-5.0	• LF-9C has approximately 111 ha of other natural vegetation; LF-1E/PI-27E has approximately 692 ha of other natural vegetation • difference sufficient to warrant inclusion
• rare species	2	-1.0	-3.0	• LF-9C has 3 rare animal species (moderate impact); LF-1E/PI-27E has 10 rare animal species (high impact) (GLAL, 1985a, pp. 104 & 114) • difference sufficient to warrant inclusion
- Air Dispersion/Air Quality				
• existing and anticipated air quality	6	-2.9	-5.0	• LF-9C has lower values for existing and short-term air quality than LF-1E/PI-27E; existence of polluting industries in vicinity of LF-1E/PI-27E • difference sufficient to warrant inclusion
• Community and Regional				
- Community and Regional				
• social stability	8	-4.6	-5.0	• LF-9C is potentially the third least impacted siting option and has a moderate potential for disruption through voluntary out-migration and residential displacement; LF-1E/PI-27E is potentially the most impacted siting option and is third most disrupted through voluntary out-migration (IER, 1985a, pp. 283 & 287) • relatively minor differences between options but high factor rank • therefore, difference sufficient to warrant inclusion
• social cohesion	6	-1.0	-4.6	• LF-9C is potentially least impacted siting option because of lowest potential for residential displacement and voluntary out-migration; LF-1E/PI-27E second most impacted siting option in terms of social cohesion through resident displacement and resident out-migration (IER, 1985a, p. 291) • difference sufficient to warrant inclusion

TABLE C.28

Major Impact Differences

LF-9C vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• Community and Regional				
• community character	8	-4.6	-3.8	• LF-9C is potentially third most impacted siting option since it is potentially most impacted in terms of land use compatibility and third most impacted in terms of heritage features and visual compatiblity; LF-1E/PI-27E is potentially the least impacted siting option since it is the most compatible with land use and has the least potential impact in terms of heritage features and the second least impact in terms of visual compatibility (IER, 1985a, p. 296-297) • relatively minor differences between options but high factor rank • therefore, difference sufficient to warrant inclusion
• community and regional economic base	8	+2.4	+5.0	• 356 new jobs and 210 additional households created with LF-9C; 422 new jobs and 303 additional households created with LF-1E/PI-27E • difference sufficient to warrant inclusion
• municipal finance	6	+5.0	+2.3	• LF-9C most positively impacted siting option since impact of payments in lieu of taxes is large compared to municipal tax base and financial impacts on operating costs of area municipality are less because of lower service levels • large increase in operating costs because of high levels of area municipal service with LF-1E/PI-27E; also, LF-1E/PI-27E requires two sites resulting in greater reduced property taxes due to negative property value impacts (Clayton, 1985b, p. 91) • difference sufficient to warrant inclusion
• tourism economy	8	0.0	-5.0	• LF-9C has no potential impacts on tourism economy; LF-1E/PI-27E potentially most impacted siting option in terms of potential impacts on tourism economy • difference sufficient to warrant inclusion
• tourism operations	6	0.0	-5.0	• LF-9C has no potential impacts on tourism operations; LF-1E/PI-27E potentially most impacted siting option in terms of potential impacts on tourism operations • difference sufficient to warrant inclusion

TABLE C.28

Major Impact Differences

LF-9C vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• Community and Regional				
- Land Use				
• existing land use	4	-3.3	-3.3	• no difference between siting options; difference screened
• planned and proposed land use	4	-3.8	-2.6	• LF-9C has predominantly agricultural land use designations with minor residential clusters and no industrial lands; LF-1E/PI-27E has generally agricultural land use designations with substantial amounts of industrial designations, considerable heavy industrial lands with official plan policies encouraging industrial development (LKA, 1985, Table H.6) • difference sufficient to warrant inclusion
- Agricultural Resources				
• stability of farm population	9	-5.0	-2.6	• LF-9C has 75% operators under age 55 and 60% of operators are full-time; LF-1E/PI-27E has 64% operators under age 55 and 16% of operators are full-time • difference sufficient to warrant inclusion
• stability of agricultural land base	8	-5.0	-2.8	• LF-9C has 76% owned farmland with about 94% of total area farmed and 91% of the land in large parcels; LF-1E/PI-27E has 27% owned farmland with about 51% of total area farmed and 51% of land in large parcels • difference sufficient to warrant inclusion
• disruption to farm economy	8	-4.9	-1.3	• LF-9C has a gross farm revenue of $8.6 million (1981); LF-1E/PI-27E has a gross farm revenue of $2.5 million (1981) • difference sufficient to warrant inclusion

TABLE C.28

Major Impact Differences

LF-9C vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Access Roads**				
– **Residents**				
• disruption of day-to-day activities and/or the use and enjoyment of property (adjacent)	8	-3.9	-0.1	• LF-9C has the second highest number of adjacent residents (775) and the second highest number of residents potentially sensitive to increased traffic (269); LF-1E/PI-27E has the lowest number of adjacent residents (9) and the lowest number of residents potentially sensitive to increased traffic (2) • difference sufficient to warrant inclusion
• disruption of day-to-day activities and/or the use and enjoyment of property (vicinity)	7	-4.5	-0.1	• LF-9C has the second highest number of residents in the access road vicinity (1716) and the noise impact zone (986); LF-1E/PI-27E has the fewest number of residents in the access road vicinity (60) (along with LF-1E) and in the noise impact zone (6) • difference sufficient to warrant inclusion
– **Community and Recreation Features**				
• disruption of operations of community and recreation features (adjacent)	2	-3.5	-0.1	• LF-9C has 14 features and 6 sensitive features adjacent to the access route; LF-1E/PI-27E has 1 feature adjacent to the access route • difference sufficient to warrant inclusion
• disruption of operations of community and recreation features (vicinity)	1	-3.4	-0.3	• LF-9C has the fourth highest number of features (11) and second highest number of sensitive features (6) in the access road vicinity, as well as the third highest number of features (17) and sensitive features (7) in the noise impact zone; LF-1E/PI-27E has the fewest features in the access road vicinity (2) and the fewest features (1) and sensitive features (1) in the noise impact zone (along with LF-1E) • difference sufficient to warrant inclusion

TABLE C.28

Major Impact Differences

LF-9C vs. LF-1E/PI-27E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-1E/PI-27E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Access Roads**				
- **Land Use**				
• existing land use	4	-5.0	-1.0	• LF-9C has the second highest number of residences (750) and commercial facilities (51) of all siting options with a high proportion of residential land use; LF-1E/PI-27E has few residences (51) and commercial facilities (2) and no residential land uses (LKA, 1985, Table H.6) • difference sufficient to warrant inclusion
• planned and proposed land use	4	-5.0	-0.6	• the access route to LF-9C travels through rural/agricultural areas with substantial amounts of residentially designated land and policies which protect agricultural lands; the access routes to LF-1E/PI-27E are primarily rural/vacant designations with no residential designations (LKA, 1985, Table H.6) • difference sufficient to warrant inclusion
- **Agricultural Resources**				
• disruption to farm traffic and cattle crossings	8	-1.5	0.0	• impacts on local roads negligible for LF-9C, but has agricultural vehicle impact index of 36,400 and 35,300 customer stops on regional roads; LF-1E/PI-27E has negligible disruption along either local or regional roads • difference sufficient to warrant inclusion
- **Natural Environment**				
• fish communities	4	-3.0	-1.0	• access route to LF-9C crosses 109.1 km and 373.9 km of regionally and locally significant fishery, respectively; LF-1E/PI-27E access routes cross 0 km of significant fishery • difference sufficient to warrant inclusion

TABLE C.29

Major Risk Differences

LF-9C vs. LF-1E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-1E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Transportation**				
• annual province-wide hazard-based spill index of OWMC generated transport	8	-3.3	-5.0	• difference between 1 spill every 8.5 years for LF-9C and 1 spill every 5.5 years for LF-1E • difference sufficient to warrant inclusion
• annual province-wide accident involvements of OWMC generated transport	8	-3.2	-5.0	• difference between 1.4 accidents per year for LF-9C and 2.1 accidents per year for LF-1E • difference sufficient to warrant inclusion
• transportation risks on local and regional access roads due to accident involvements of OWMC generated transport	10	-4.6	-0.2	• difference between 1 accident every 1.2 years for LF-9C and 1 accident every 5.4 years for LF-1E • difference sufficient to warrant inclusion
• transportation risks on local and regional access roads due to hazard-based spills of OWMC generated transport	10	-3.9	-0.2	• difference between 1 spill every 20.4 years for LF-9C and 1 spill every 90.3 years for LF-1E • difference sufficient to warrant inclusion
• **Air Quality**				
• risk from direct inhalation of emissions - chronic	9	-1.5	-2.4	• LF-9C has lower values for relative existing and future population exposure - incinerator stack emissions • relatively minor differences between options but high factor rank • therefore, difference sufficient to warrant inclusion
• risk from direct inhalation of emissions - acute	8	-2.9	-3.8	• LF-9C has lower values for relative existing and future population exposure - upset emissions from incinerator stack and relative existing and future population exposure - upset emissions from low elevation sources • relatively minor difference between options but high factor rank • therefore, difference sufficient to warrant inclusion

TABLE C.29

Major Risk Differences

LF-9C vs. LF-1E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-1E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Air Quality**				
• risk from ingestion of cistern and pond water	6	-1.5	-5.0	• LF-1E has significantly higher values for relative exposure from ingestion of cistern and pond water for both incinerator stack and fugitive emissions • difference sufficient to warrant inclusion
• risk from consumption of crops and livestock	5	-5.0	-1.7	• LF-1E has lower values for all indicators for this factor; LF-9C located in rural/agricultural area • difference sufficient to warrant inclusion
• **Hydrogeologic Suitability**				
• capability of providing natural containment	10	-1.0	-5.0	• confining layer with LF-9C is uniform and laterally and vertically continuous, resulting in long contaminant breakthrough times; confining layer thins to extinction under southeastern portion of LF-1E as a result of a local morainal feature and sand layers associated with the moraine could be present within confining layer (GLAL, 1985b, p.80) • difference sufficient to warrant inclusion
• ground water use	7	-5.0	-5.0	• no difference between siting options, difference screened
• **Surface Water Suitability**				
• potential for surface water use interference	7	-2.5	-0.8	• downstream water use index 36 for LF-9C; downstream water use index 14 for LF-1E/PI-27E • difference sufficient to warrant inclusion

TABLE C.30

Major Impact Differences

LF-9C vs. LF-1E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-1E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Site**				
- **Residents**				
• displacement of residents	9	-1.3	-4.0	• LF-9C has the least number of residents presently living on-site (9) and is potentially least impacted overall; LF-1E has the greatest number of residents displaced (43) and is the second most impacted siting option overall with respect to displacement of residents • difference sufficient to warrant inclusion
- **Business**				
• displacement of businesses	4	0.0	-3.6	• no businesses displaced with LF-9C; LF-1E involves displacement of six businesses with 22 employees and $1.7 million in sales • difference sufficient to warrant inclusion
- **Land Use**				
• existing land use	6	-1.2	-4.7	• LF-9C has the fewest number of residences on-site (3) and no commercial or industrial facilities; LF-1E has a high number of residences on-site (16) and one commercial use on-site (LKA, 1985, Table H.6) • difference sufficient to warrant inclusion
• planned and proposed land use	7	-5.0	-4.7	• LF-9C has generally agricultural land use designations with protective policies for agriculture; LF-1E has similar policies and designations but may permit public treatment facilities without amendment to the Official Plan • negligible difference between options; difference screened
• land use stability	2	-3.6	-4.1	• LF-9C has moderate proportion of land under absentee ownership, no land sales and all buildings in good condition; LF-1E has a moderately low proportion of land under absentee ownership, no land sales but only a moderate percentage of buildings in good condition (LKA, 1985, Table H.6) • negligible difference between options; difference screened

TABLE C.30

Major Impact Differences

LF-9C vs. LF-1E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-1E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Site**				
– **Agricultural Resources**				
• displacement of farms with on-site headquarters	6	-2.6	-3.9	• LF-9C involves the displacement of two operations with headquarters on-site, both owner-operated; LF-1E involves the displacement of seven operations with headquarters on-site, all owner-operated • difference sufficient to warrant inclusion
• loss of farmland	6	2.3	-3.4	• LF-9C involves loss of 91 ha Class 1 equivalents; LF-1E involves loss of 177 ha Class 1 equivalents • difference sufficient to warrant inclusion
– **Natural Environment**				
• rare species	8	-5.0	-1.0	• LF-9C has high potential impact on rare plant and animal species; LF-1E has low potential impact on rare plant species • difference sufficient to warrant inclusion
• natural vegetation displaced	4	-1.0	-5.0	• approximately 23 ha of natural vegetation displaced with LF-9C; approximately 92 ha of natural vegetation displaced with LF-1E • difference sufficient to warrant inclusion
• potential for occurrence of other significant features	6	-1.0	-5.0	• low potential for finding additional significant features on LF-9C; high potential on LF-1E to find additional rare species (GLAL, 1985a, p.88) • difference sufficient to warrant inclusion

TABLE C.30

Major Impact Differences

LF-9C vs. LF-1E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-1E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• Site Vicinity				
- Residents				
• property value impacts	7	-1.2	-1.8	• LF-9C has a low level of negative property value impacts in the site vicinity ($435,000); LF-1E has a moderately low degree of negative property value impacts in site vicinity ($679,000) (Clayton, 1985a, pp.25-26) • negligible difference between options; difference screened
• disruption of use and enjoyment of property and/or day-to-day activities (adjacent to site)	10	-2.4	-1.3	• LF-9C has 40 residents adjacent to site and 15 residents spending most time on property adjacent to site; LF-1E has 31 residents adjacent to site and six residents spending most time on property adjacent to site • difference sufficient to warrant inclusion
• disruption of use and enjoyment of property and/or day-to-day activities (non-adjacent)	9	-4.8	-2.7	• LF-9C has 272 residents in site vicinity, 25 residents spending most time on properties within 55 dBa noise impact zone and moderate impact with respect to visual intrusion; LF-1E has 737 residents in site vicinity, six residents spending most time on properties within 55 dBa noise impact zone and is least impacted in terms of visual intrusion • difference sufficient to warrant inclusion
- Community and Recreation Features				
• disruption of operations of community and recreation features (adjacent to site)	5	0.0	0.0	• no difference between options; difference screened
• disruption of operations of community and recreation features (site vicinity)	3	-0.3	-1.4	• LF-9C has two features in site vicinity; LF-1E has 14 features in site vicinity and six sensitive uses in site vicinity • difference sufficient to warrant inclusion
- Land Use				
• existing land use	8	-2.0	-3.6	• LF-9C has moderately low numbers of residences within the site vicinity (75), few commercial uses (7) and no industrial uses; LF-1E has a moderately high number of residences within the site vicinity (215), few commercial uses (9) and no industrial uses • difference sufficient to warrant inclusion

TABLE C.30

Major Impact Differences

LF-9C vs. LF-1E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-1E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Site Vicinity**				
- **Land Use**				
• planned and proposed land use	7	-4.4	-4.4	• no difference between siting options; difference screened
• land use stability	3	-5.0	-3.6	• LF-9C has a low proportion of land under absentee land ownership (11%) for land sales (9) and steadily rising land values; LF-1E has a moderate proportion of land under absentee land ownership (35%) relatively few land sales (7) and no discernible trend in land values • difference sufficient to warrant inclusion
- **Agricultural Resources**				
• partial displacement of farms	9	-2.3	-3.4	• 1 farm affected with LF-9C with average parcel size of 20 ha of 16% of land base lost is owned; two farms affected with LF-1E with average parcel size of 20 ha and 25% of land base lost is owned • difference sufficient to warrant inclusion
• disruption of adjacent farm operations	10	-4.6	-2.1	• LF-9C has six adjacent farms with headquarters, eight operators with owned land and a livestock density of 1.14 animal units/ha; LF-1E has three adjacent farms with headquarters, five operators with owned land and a livestock density of 0.26 animal units/ha • difference sufficient to warrant inclusion
• disruption of non-adjacent farm operations	9	-5.0	-2.9	• LF-9C has 71% non-adjacent vicinity in crops and a livestock density of 2.44 animal units/ha; LF-1E has 41% non-adjacent vicinity in crops and a livestock density of 0.25 animal units/ha • difference sufficient to warrant inclusion
- **Natural Environment**				
• significant environmental units (SEUs)	4	-1.0	-3.0	• approximately 145 ha of SEU potentially impacted with LF-9C; approximately 386 ha of SEU potentially impacted with LF-1E • difference sufficient to warrant inclusion
• fish and wildlife features of significance	4	-3.0	-3.0	• no difference between siting options; difference screened

TABLE C.30

Major Impact Differences

LF-9C vs. LF-1E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-1E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Site Vicinity**				
– **Natural Environment**				
• other natural vegetation	3	-1.0	-3.0	• LF-9C has approxiamtely 111 ha of other natural vegetation; LF-1E has approximately 333 ha of other natural vegetation • difference sufficient to warrant inclusion
– **Air Dispersion/Air Quality** • existing and anticipated air quality	6	-2.9	-3.5	• LF-9C has lower values for existing air quality and short-term air quality; LF-1E has lower values for estimated effect on air quality - fugitive and incinerator stack emissions • negligible difference between siting options; difference screened
• **Community and Regional**				
– **Community and Regional**				
• social stability	8	-4.2	-4.9	• LF-9C is potentially the third least impacted siting option and has a moderate potential for disruption through voluntary out-migration and residential displacement; LF-1E is the third most stable siting option, has the second highest potential disruption through resident displacement and is potentially second least impacted by residents voluntarily leaving the area (IER, 1985a, pp.283 and 287) • relatively minor difference between options but high factor rank • therefore, difference sufficient to warrant inclusion
• social cohesion	6	-1.0	-4.6	• LF-9C is potentially least impacted siting option because of lowest potential for residential displacement and voluntary out-migration; LF-1E is potentially third highest impacted of all siting options in terms of social cohesion, second most impacted in terms of resident displacement but second least impacted in terms of resident out-migration (IER, 1985a, p.291) • difference sufficient to warrant inclusion

TABLE C.30

Major Impact Differences

LF-9C vs. LF-1E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-1E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• Community and Regional				
- Community and Regional				
• community character	8	-4.6	-4.0	• LF-9C is potentially the third most impacted siting option since it is potentially most impacted in terms of land use compatibility and third most impacted in terms of heritage features and visual compatibility; LF-1E is the second least impacted of all siting options since the potential impact on land use compatibility and heritage features is the second least and it is the least impacted in terms of visual compatibility (IER, 1985a, p.296) • relatively minor difference between options but high factor rank • therefore, difference sufficient to warrant inclusion
• community and regional economic base	8	+2.4	+4.5	• 356 new jobs and 210 additional households created with LF-9C; 395 new jobs and 116 additional households created with LF-1E • difference sufficient to warrant inclusion
• municipal finance	6	+5.0	+2.8	• LF-9C most positively impacted siting option since impact of payments in lieu of taxes is large compared to municipal tax base and financial impacts on operating costs of area municipality are less because of lower service levels; LF-1E is third most positively; operating costs because of high levels of area municipal service (Clayton, 1985b, p.91) • difference sufficient to warrant inclusion
• tourism economy	8	0.0	-5.0	• LF-9C has no potential impacts on tourism economy; LF-1E potentially most impacted siting option (along with LF-1E/PI-27E) in terms of potential impacts on tourism economy • difference sufficient to warrant inclusion
- Land Use				
• existing land use	4	-3.3	-1.7	• LF-9C has limited residential land but no industrial land use; LF-1E has a limited amount of residential land use but significant amounts of compatible industrial land use (LKA, 1985, Table H.6 • difference sufficient to warrant inclusion

TABLE C.30

Major Impact Differences

LF-9C vs. LF-1E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-1E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• Community and Regional				
– Land Use				
• planned and proposed land use	4	-3.8	-2.6	• LF-9C has predominantly agricultural land use designations with minor residential clusters and no industrial lands; LF-1E has generally agricultural lands with substantial amounts of compatible industrial designations, industrial development policies are somewhat offset by policies protecting agricultural uses and permitting residential in-filling in Cooks Mills area (LKA, 1985, Table H.6) • difference sufficient to warrant inclusion
– Agricultural Resources				
• stability of farm population	8	-5.0	-2.6	• LF-9C has 75% operators under age 55 and 60% of operators are full-time; LF-1E has 65% operators under age 55 and 16% of operators are full-time • difference sufficient to warrant inclusion
• stability of agricultural land base	8	-5.0	-3.4	• LF-9C has 76% owned farmland with about 94% of total area farmed and 91% of the land in large parcels; LF-1E has 39% owned farmland with about 62% of total area farmed and 53% of the land in large parcels • difference sufficient to warrant inclusion
• disruption to farm economy	8	-4.9	-1.5	• LF-9C has a gross farm revenue of $8.6 million (1981); LF-1E has a gross farm revenue of $2.0 million (1981) • difference sufficient to warrant inclusion

TABLE C.30

Major Impact Differences

LF-9C vs. LF-1E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-1E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• Access Roads				
- Residents				
• disruption of day-to-day activities and/or the use and enjoyment of property (adjacent)	8	-3.9	-0.1	• LF-9C has the second highest number of adjacent residents (775) and the second highest number of residents potentially sensitive to increased traffic (269); LF-1E has the second least number of adjacent residents (17) and the second lowest number of residents potentially sensitive to increased noise (3) • difference sufficient to warrant inclusion
• disruption of day-to-day activities and/or the use and enjoyment of property (vicinity)	7	-4.5	-0.1	• LF-9C has the second highest number of residents in the access road vicinity (1716) and the noise impact zone (986); LF-1E has the lowest number of residents in the access road vicinity (60) (along with LF-1E/PI-27E) and the second lowest number of residents within the noise impact zone (17) • difference sufficient to warrant inclusion
- Community and Recreation Features				
• disruption of operations of community and recreation features (adjacent)	2	-3.5	-0.1	• LF-9C has 14 features and six sensitive features adjacent to the access route; LF-1E has one feature adjacent to the access route • difference sufficient to warrant inclusion
• disruption of operations of community and recreation features (vicinity)	1	-3.4	-0.3	• LF-9C has the fourth highest number of features (11) and second highest number of sensitive features (6) in the access road vicinity, as well as the third highest number of features (17) and sensitive features (7) in the noise impact zone; LF-1E has the fewest features in the access road vicinity (2) and the fewest features (1) and sensitive features (1) in the noise impact zone (along with LF-1E/PI-27E) • difference sufficient to warrant inclusion
- Land Use				
• existing land use	4	-5.0	-0.8	• LF-9C has the second highest number of residences (750) and commercial facilities (1) and no residential land uses (LKA, 1985, Table H.6) • difference sufficient to warrant inclusion

TABLE C.30

Major Impact Differences

LF-9C vs. LF-1E

FACTOR GROUP	RANKING AND SUITABILITY			MAGNITUDE AND SIGNIFICANCE OF DIFFERENCES
		LF-9C	LF-1E	
	FACTOR RANK	FACTOR SUITABILITY LEVEL	FACTOR SUITABILITY LEVEL	
• **Access Roads**				
- **Land Use**				
• planned and proposed land use	4	-5.0	-0.6	• the access route to LF-9C travels through rural/agricultural areas with substantial amounts of residentially designated land and policies which protect agricultural lands; the access route to LF-1E has primarily rural/vacant designations with no residential designations (LKA, 1985, Table H.6) • difference sufficient to warrant inclusion
- **Agricultural Resources**				
• disruption to farm traffic and cattle crossings	8	-1.5	0.0	• impacts on local roads negligible for LF-9C but has agricultural vehicle impact index of 36,400 and 35,200 customer stops on regional roads; LF-1E has no customer/service vehicle stops along local or regional roads and the agricultural vehicle impact index is very low along both regional and local roads • difference sufficient to warrant inclusion
- **Natural Environment**				
• fish communities	4	-3.0	-1.0	• access route to LF-9C crosses 109.1 km and 373.90 km of regionally and locally significant fishery, respectively; LF-1E access routes cross 0 km of significant fishery • difference sufficient to warrant inclusion

APPENDIX D

APPENDIX D

INTRODUCTION

Appendix D consists of the following tables:

- Table D.1 - Summary - Rationale, Magnitude and Significance of Risk Rankings by Discipline
- Table D.2 - Summary - Rationale, Magnitude and Significance of Impact Rankings by Discipline
- Table D.3 - Risk Tradeoffs - LF-3C and LF-4N/PI-1N

Table D.1 provides a summary of the siting option rankings by risk consultant. The table also provides a rationale for the rankings, the relative magnitude and significance and the absolute magnitude and significance.

Table D.2 provides a summary of the siting option rankings by impact consultant. The table also provides a rationale for the rankings, the relative magnitude and significance and the absolute magnitude and significance.

Table D.3 provides a summary of the risk tradeoffs between LF-3C and LF-4N/P1-1N. The table presents the tradeoffs in terms of absolute differences, relative differences, mitigation potential, uncertainty and policy implications.

TABLE D.1

Summary - Rationale, Magnitude and Significance of Risk Rankings by Discipline[2]

CONSULTANT	RANKINGS[1]	RATIONALE FOR RANKING	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
RISK				
MMD - **Transportation** references from: M.M. Dillon Ltd. 1985b. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Transportation	**LF-4N/PI-13N** **LF-47/PI-1N** **LF-1E/PI-27E** **and** **LF-1E** **LF-9C** **LF-3C**	° reflects values for both accident involvement factors and spill factors ° aggregated value for all factors: LF-4N/PI-13N -55.4 LF-4N/PI-1N -58.4 LF-1E -84.0 LF-1E/PI-27E -84.0 LF-9C -137.0 LF-3C -152.0	° "generally the siting options located within the same geographical areas were ranked very close together" (p.230) ° "the differences, however, were greater when comparing the sites of different geographical areas" (p.230) ° "the differences between the northern sites and the eastern sites were not as great as the differences between the eastern sites and the central sites" (p.230)	° "the range of spill and accident involvement values across all options was too small to determine a threshold for site elimination" (p.169) ° "annual spills on the total system ranged between 2.0 and 2.8, and annual accident involvements ranged between 5.3 and 8.3" (p.170) ° "...when spills of all categories are considered (between 2.0 and 2.8 spills annually), only the northern sites (2.0 to 2.2 spills annually) have a significantly lower number of spills than the sites in the other regional areas (2.5 to 2.8 spills annually)" (p.237)

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[1] Ranked from most preferred to least preferred

[2] The points on this table should be read column-by-column by discipline, rather than left to right on a point-by-point basis

TABLE D.1

Summary - Rationale, Magnitude and Significance of Risk Rankings by Discipline[2]

CONSULTANT	RANKINGS[1]	RATIONALE FOR RANKING	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
RISK				
MMD - Transportation (Cont'd)			° "the site rankings were sensitive to the importance applied to the local and regional access road study area and the province-wide study area" (p.xv) ° the local and regional study area favoured the eastern sites (LF-1E, PI-27E/LF-1E) and ranked the central sites (LF-3C and LF-9C) the lowest, while the province-wide factors favoured the northern sites (PI-13N/LF-4N and PI-1N/LF-4N), and ranked the eastern sites the lowest. The overall ranking of risk factors, which gave a greater importance to the local and regional access study area, determined the site rankings" (p.xv)	° "when comparing the siting options in terms of spills posing a potential risk to human health ... the differences between all siting options were too small to discern any statistical difference" (p.237) ° "a statistical analysis of the total number of annual accident involvement for each siting option indicated that only the northern sites, with 5.3 to 6.0 accident involvements annually, are significantly different from the other sites, with 7.1 to 8.3 accident involvements annually, at the 5% significance level" (p.238) ° "...the differences between the siting

TABLE D.1

Summary - Rationale, Magnitude and Significance of Risk Rankings by Discipline[2]

CONSULTANT	RANKINGS[1]	RATIONALE FOR RANKING	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
RISK				
MMD - Transportation (Cont'd)			o "...although the rankings are sensitive to the relative importance of the local and regional access roads factor, the rank order of the sites would not be altered unless there was a very significant shift in the weights applied to these two factors. Such a change would not realistically reflect the relative importance of these factors with respect to other risk factors applied" (p.263)	options in terms of fatal or personal injury accidents are too small to be statistically significant" (p.242)

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TABLE D.1

Summary - Rationale, Magnitude and Significance of Risk Rankings by Discipline[2]

CONSULTANT	RANKINGS[1]	RATIONALE FOR RANKING	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
RISK		LF-3C	Natural Containment	
GLA - Hydrogeology references from: Gartner Lee Associates Ltd. 1985a. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Geologic, Hydrogeologic and Geotechnical Considerations.	LF-3C LF-9C LF-1E and LF-1E/PI-27E LF-4N/PI-1N LF-4N/PI/13N	° "confining layer is uniform and laterally and vertically continuous" (p.80) "ranging from about 23 to 31 m" (p.93) ° contaminant breakthrough times - long (p.80) ° conventional landfill (10 m deep excavation - 600 - 1900 years) (p.95) ° central operating area - at surface 5,200 years and at 8 m - 4,300 years (p.95) ° alternative ground water supplies available (p.89) ° existing ground water use and potential demand - limited ° "aquifer use is limited primarily to domestic and agricultural requirements" (p.89)	° LF-3C (level -1) and LF-9C (level -1) ° LF-1E and LF-1E/PI-27E (level -5) ° LF-4N/PI-1N (level -6) ° LF-4N/PI-13N (fails to provide natural containment) ° LF-3C and LF-9C ranked together ° wide gaps between LF-3C, LF-9C and LF-1E/LF-1E/PI-27E and between LF-1E/PI-27E and LF-4N/PI-1N; and between LF-4N/PI-13N ° LF-4N/PI-13N fails to meet thresholds of acceptability ° gaps in suitability reflected in suitability levels; suitability levels for natural containment, 2, 3 and 4 were not utilized; the sites are either considered to be relatively	° range of access options not narrow ° LF-4N/PI-13N - failure to provide natural containment - not a least preferred situation but rather a failure to meet an absolute requirement ° differences across remaining options also very broad as exhibited by exclusion of intermediate suitability levels ° low containment at LF-4N/PI-1N an absolute constraint, although option (based on Phase 4A data base) acceptable ° difference between Niagara Falls options and West Lincoln options, not substantial in containment breakthrough times, if

TABLE D.1

Summary - Rationale, Magnitude and Significance of Risk Rankings by Discipline[2]

CONSULTANT	RANKINGS[1]	RATIONALE FOR RANKING	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
RISK		LF-9C		
GLA - **Hydrogeology** (Cont'd)		° "confining layer is uniform and laterally and vertically continuous" (p.80) "ranging from about 30 to 35 m" (p.93) ° contaminant breakthrough times - long (p.80) ° conventional landfill (10 m deep excavation 1,200 to 1,700 years) (p.95) ° central operating area - at surface 4,000 years and at 8 m - 3,400 years (p.95) ° alternative ground water supplies - available (p.89) ° existing ground water use and potential demand - "aquifer may be capable of meeting more demanding water use requirements" (p.89)	unconstrained or potentially constrained (p.74) ° distinction between levels -1 (LF-3C/LF-9C) and -5 (LF-1E/LF-1E/PI-27E) - uniform predictability of geologic conditions versus locally variable predictability of geologic conditions and between long breakthrough times and locally variable breakthrough times as a result of "some uncertainty respecting the direction and rate of contaminant movement" (p.74) ° distinction between levels -1 and (LF-1E/PI-27E) -5 and -6 (LF-4N/PI-1N) - variable contaminant breakthrough times	local constraints avoided; however locally occurring geologic features at both Niagara Falls sites result in absolute uncertainty regarding the direction and rate of contaminant movement; with Niagara Falls siting options - greater potential that options may prove to be unacceptable if more detailed investigations undertaken ° residual uncertainty, even with more detailed investigations at Niagara Falls siting options, will also be greater ° ground water use distinctions not as great in absolute sense - a reflection of conclusion that any ground water use a

TABLE D.1

Summary - Rationale, Magnitude and Significance of Risk Rankings by Discipline[2]

CONSULTANT	RANKINGS[1]	RATIONALE FOR RANKING	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
RISK GLA - **Hydrogeology** (Cont'd)		LF-1E ° "confining layer thins to extinction under southeastern portion of site as a result of a local morainal feature. Sand layers associated with the moraine could be present within the confining layer under the site" (p.80) ° predictability of geologic conditions - locally variable - breakthrough time anticipated to vary locally as a result of local variability in confining layer thickness (p.81) ° if shallow sand layers avoided conventional landfill (5 m excavation - 750-2500 years); central operating area - at surface - 1200-2600 years; at 8 m - 830-2200 (p.96)	versus short contaminant breakthrough times; "rating is dominated by the thin confining layer which results in short breakthrough times and corresponding low natural containment" (p.75) ° distinction between level -6 (LF-4N/PI-1N) and basic acceptability (LF-4N/PI-13N) is between low natural containment and no natural containment, i.e. failure to provide a second level of protection (p.75) Ground Water Use ° LF-3C (level -1) ° LF-9C, LF-1E, LF-1E/PI-27E, LF-4N/PI-1N and LF-4N/PI-13N (level -5)	concern if no or inadequate natural containment, the imprecise nature of the data base, not possible to ensure control of ground water use or to predict with precision ground water use ° secondary importance of ground water use reflected in role of refining site ranking distinctions based on natural containment; also reflected in conclusion that ground water use should not be used as a basic acceptability screen

TABLE D.1

Summary - Rationale, Magnitude and Significance of Risk Rankings by Discipline[2]

CONSULTANT	RANKINGS[1]	RATIONALE FOR RANKING	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
RISK				
GLA - **Hydrogeology** (Cont'd)		° alternative ground water supplies available (p.89) ° existing ground water use and and potential demand - potential for expansion - "aquifer may be capable of meeting more stringent water use requirements" (p.90) LF-1E/PI-27E ° "confining layer varies under both sites as a result of locally occurring geologic features - LF-1E morainal feature to southeast - PI-27E buried sand to northwest" (p.81) ° "sand layers could be present within the confining layer under portions of both sites" (p.81)	gaps in suitability are reflected in suitability levels ° suitability levels -2, -3 and -4 not used "in the event that the potential exists for impacting the existing source of supply, the suitability of the site for facility development would require consideration of the characteristics of the water resource impacted and the availability of alternative water supplies" (p.76) ° difference between levels -1 and -5 a reflection of alternative ground water supplies potentially available or alternative water supplies are not available or between	

TABLE D.1

Summary - Rationale, Magnitude and Significance of Risk Rankings by Discipline[2]

CONSULTANT	RANKINGS[1]	RATIONALE FOR RANKING	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
RISK				
GLA - **Hydrogeology** (Cont'd)		° predictability of geologic conditions - locally variable (p.81) ° contaminant breakthrough time - variable (p.81) ° if shallow sand layers avoided - PI-27E - central operating area - at surface - 2600 years; at 8 m - 2000 years (p.98) ° alternative ground water supplies - available ° existing ground water use and potential demands - potential for expansion at both sites - "aquifer may be capable of meeting more stringent water use requirements" (p.90) LF-4N/PI-1N ° "confining layer is uniform and laterally	limited existing ground water use and potential demand, i.e. "use of the local aquifer(s) is limited by water quality or quality considerations to domestic and agricultural use" (p.75) and potential for exposure; "existing source of supply is capable of meeting more demanding water use requirements such as those of communities and industries" (p.76) ° when natural containment and ground water use combined - gap between LF-3C and LF-9C - a reflection of ground water use difference ° wide gaps between LF-9C and LF-1E/LF-1E/PI-27E and between LF-1E/LF-1E/PI-27E and	

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TABLE D.1

Summary - Rationale, Magnitude and Significance of Risk Rankings by Discipline[2]

CONSULTANT	RANKINGS[1]	RATIONALE FOR RANKING	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
RISK				
GLA - **Hydrogeology** (Cont'd)		and vertically continuous at both sites (p.82) ° contaminant breakthrough times - short; at 10 m - conventional landfill design 1 to 68 years (p.99); with adjustments to facility placement - 57-150 years ° "LF-4N underlain by two sand layers which have aquifer potential and appear to have off-site continuity" (p.99) ° PI-1N - breakthrough times - central operating area - at surface - 29 years (p.100) ° alternative ground water supplies available ° existing ground water use and potential demand - potential for	LF-4N/PI-1N a reflection of greater importance attached to natural containment (as exemplified by factor rankings)	

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TABLE D.1

Summary - Rationale, Magnitude and Significance of Risk Rankings by Discipline[2]

CONSULTANT	RANKINGS[1]	RATIONALE FOR RANKING	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
RISK				
GLA - **Hydrogeology** (Cont'd)		expansion limited - "aquifer at LF-4N may be capable of meeting more demanding water use requirements - aquifer use at PI-1N is limited primarily to domestic and agricultural requirements" (p.91) LF-4N/PI-13N ° "The confining layer is uniform and laterally and vertically continuous at LF-4N. The confining layer at PI-13N is locally discontinuous as a result of erosion" (p.82) ° contaminant breakthrough times - short ° LF-4N as above ° PI-13N - 8 m deep "excavations as		

TABLE D.1

Summary - Rationale, Magnitude and Significance of Risk Rankings by Discipline[2]

CONSULTANT	RANKINGS[1]	RATIONALE FOR RANKING	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
RISK				
GLA - **Hydrogeology** (Cont'd)		proposed for the central operating area would be expected to locally penetrate the confining layer" (p.85); even with central operating area limited to 5 m, still fails to provide a second level of protection (p.86) ° absence of suitable alternative source of ground water supply in the vicinity of PI-13N (p.92) ° aquifer use at PI-13N is limited to domestic and agricultural requirements (p.92)		

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TABLE D.1

Summary - Rationale, Magnitude and Significance of Risk Rankings by Discipline[2]

CONSULTANT	RANKINGS[1]	RATIONALE FOR RANKING	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
RISK GLA - Surface Water references from: Gartner Lee Associates Ltd. 1985c. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Surface Water	LF-1E LF-1E/PI-27E LF-9C LF-4N/PI-1N LF-3C LF-4N/PI-13N	LF-1E o "lowest intensity of surface water use of all sites. The downstream water use index was the lowest of all options. Furthermore, there were no potable uses immediately downstream from the site. Flooding constraints with this site were considered to be minor and are easily corrected" (p.119) LF-1E/PI-27E o Same comments as for LF-1E. "This option was slightly less preferred than LF-1E (integrated) due to minor flood constraints that are associated with site PI-27E" (p.121)	Flooding o LF-1E (level 1) o LF-1E/PI-27E (level 1) (this option was slightly less preferred than LF-1E) (p.121) o LF-9C (level 3) o LF-4N/PI-1N (level 3) - minor difference from LF-9C based on flooding potential; "flooding differences are not considered to be significant" (p.120) o LF-3C (level 4); moderate difference a reflection of greater flooding constraint o LF-4N/PI-1N (level 5) moderate difference - a reflection of greater importance attached to water use, "constraint is local potable water" (p.120)	Flooding o "only one potential constraint was identified ...the floodplain associated with Beaver Creek on candidate site LF-3C" (p.96) o "...the facility layout was modified and its potentially severe flooding constraint was removed" (p.96) Downstream Water Use Interferences o "The analysis revealed that although a number of water uses such as irrigation were identified, there were no major sensitive water uses such as a municipal water intake. Furthermore, the analysis did not identify any future major uses planned

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Summary - Rationale, Magnitude and Significance of Risk Rankings by Discipline[2]

CONSULTANT	RANKINGS[1]	RATIONALE FOR RANKING	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
RISK GLA - **Surface Water** (Cont'd)	LF-1E LF-1E/PI-27E LF-9C LF-4N/PI-1N LF-3C LF-4N/PI-13N	LF-9C ° "...considered to have minor constraints from a flooding viewpoint ...considered to have moderate constraints with respect to downstream water uses (moderately high downstream water use index but no potable uses in the site vicinity)" (p.121) LF-4N/PI-1N ° "The water use downstream as measured by downstream water use index) from this siting option was slightly greater than previous options. No potable uses were identified downstream from these sites. This siting option was considered to be moderately constrained		downstream of the candidate site" (p.97) Surface Water Suitability (Transportation) ° "The analysis identified a number of water uses but no major sensitive water uses such as a municipal intake" (p.97)

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TABLE D.1

Summary - Rationale, Magnitude and Significance of Risk Rankings by Discipline[2]

CONSULTANT	RANKINGS[1]	RATIONALE FOR RANKING	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
RISK				
GLA - **Surface Water** (Cont'd)		due to flood susceptibility. The flooding concern was with respect to the proximity of the Indian Creek floodplain to site LF-4N; however, these floodplains can be avoided" (p.122) LF-3C ° This fully integrated siting option was considered to have moderate surface water use constraint similar to option LF-9C (however, more constrained). It was also considered to have major constraints due to flood susceptibility as a result of the proximity of the Beaver Creek and Welland River floodplains" (p.122)		

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Summary - Rationale, Magnitude and Significance of Risk Rankings by Discipline[2]

CONSULTANT	RANKINGS[1]	RATIONALE FOR RANKING	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
RISK **GLA - Surface Water** (Cont'd)		LF-4N/PI-13N ° "The main reason for this siting option's low rating was due to the occurrence of potable water uses from streams downgradient from the facilities (PI-13N). These potable uses, coupled with the fact that this site had a high downstream water use index resulted in a high constraint for water use. Flooding constraints were associated with LF-4N (discussed previously) and were considered to be avoidable" (p.122)		

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TABLE D.1

Summary - Rationale, Magnitude and Significance of Risk Rankings by Discipline[2]

CONSULTANT	RANKINGS[1]	RATIONALE FOR RANKING	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
RISK				
ORF - Air references from: Ontario Research Foundation. 1985. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Atmospheric Conditions and Environ Corporation. 1985. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Generic Risk Assessment Volume 1	LF-3C LF-9C and LF-1E LF-1E/PI-27E LF-4N/PI-1N LF-4N/PI-13N	° reflection of weighted suitability levels for the siting options - risk factors: LF-3C -2.2 LF-9C -2.3 LF-1E -2.3 LF-1E/PI-27E -2.5 LF-4N/PI-1N -2.9 LF-4N/PI-13N -3.2 ° reflects the fact that "the West Lincoln sites are in a comparatively sparsely populated area" (p.65) and that, based on "the generic risk assessment indicates that the direct inhalation pathways are of significantly greater concern than the indirect pathways" (p.65)	° as reflected in suitability levels: LF-3C and LF-9C ranked very close together ° LF-9C and LF-1E were ranked at the same level ° moderate gap between LF-1E/PI-27E and LF-1E/LF-9C ° somewhat more substantial gap between LF-1E/PI-27E and LF-4N/PI-1N ° further quite substantial gap between LF-4N/PI-1N and LF-4N/PI-13N ° ORF sensitivity analyses confirmed the overall preference for the West Lincoln sites (p.vii) ° LF-1E/PI-27E becomes the least preferred site with greater weight to chronic and acute (p.74)	° "dispersion analysis of potential atmospheric emissions from the proposed OWMC facility showed that such emissions would be well within applicable air quality standards and guidelines at all candidate sites" (p.53) ° relevant comments from generic risk assessment report: General ° "The risk estimates developed in the generic risk assessment are considered to overstate the incremental risk associated with OWMC's hazardous waste management facility. Although these risk estimates are

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TABLE D.1

Summary - Rationale, Magnitude and Significance of Risk Rankings by Discipline[2]

CONSULTANT	RANKINGS[1]	RATIONALE FOR RANKING	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
RISK				
ORF - Air (Cont'd)			° order of magnitude differences were identified between direct and indirect air pathways	appropriate for site selection purposes, they should not be considered as measures of absolute risk" (p.vi) ° "Risk estimates were based on the preliminary design of the facility and did not include any provision for mitigation of potentially adverse health effects. Throughout the risk assessment, a series of conservative assumptions was made in defining the scenarios for the characterization of facility releases, environmental transport modelling and estimation of human dose. These assumptions were

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CONSULTANT	RANKINGS[1]	RATIONALE FOR RANKING	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
RISK				
ORF - Air (Cont'd)				considered conservative in that they resulted in the selection of facility operating parameters and environmental conditions that would tend to overestimate the magnitude of human exposures experienced. As a result of these conservative assumptions, the predicted human health risks are likely overstated" (p.iii) o by comparing the air risk pathways "to risk levels associated with other human activities ...it is evident that the health risks predicted for the operation of the OWMC facility, based on a series of conservative assumptions, are less significant than risks

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CONSULTANT	RANKINGS[1]	RATIONALE FOR RANKING	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
RISK				
ORF - Air (Cont'd)				normally and routinely experienced" (p.88) Acute ° "It must also be emphasized that the predicted levels of exposure are based on a number of conservative assumptions used in formulating the exposure scenarios, so that the risk levels are likely overstated" (p.85) ° "In the case of the incinerator stack scrubber failure ...no adverse health effects would be expected, although slight odour or minor, reversible irritation effects might be experienced" (p.v) ° For the transportation spill and tank farm

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[1] Ranked from most preferred to least preferred

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CONSULTANT	RANKINGS[1]	RATIONALE FOR RANKING	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
RISK				
ORF - Air (Cont'd)				fire, further evaluation indicated that potentially severe health effects could be experienced. Both events, however, are believed to have low probabilities of occurrence, and it should be emphasized that the severity of the actual adverse health effect would be strongly influenced by such factors as distance from the human receptor from the spill or fire, the duration of exposure and the amount of toxic pollutant released" (pp.v-vi) Chronic o "For chronic emissions, the long-term health risks, both

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[1] Ranked from most preferred to least preferred

[2] The points on this table should be read column-by-column by discipline, rather than left to right on a point-by-point basis

TABLE D.1

Summary - Rationale, Magnitude and Significance of Risk Rankings by Discipline[2]

CONSULTANT	RANKINGS[1]	RATIONALE FOR RANKING	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
RISK				
ORF - Air (Cont'd)				individually and in combination, were all judged acceptable relative to the one in a million cancer risk criterion established for this study. The risks from direct inhalation of both fugitive and stack emissions, however, were more significant than those from the indirect pathways of drinking of water from ponds and cisterns, consumption of contaminated crops, or consumption of contaminated meat and milk" (pp.vi-vii)

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[1] Ranked from most preferred to least preferred

[2] The points on this table should be read column-by-column by discipline, rather than left to right on a point-by-point basis

TABLE D.2

Summary - Rationale, Magnitude and Significance of Impact Rankings by Discipline[1]

CONSULTANT	RANKINGS	RATIONALE FOR RANKINGS	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
AGRICULTURE (Ecologistics Ltd.) References from: Ecologistics Ltd., 1985. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Agriculture	1. LF-1E/PI-27E 2. LF-1E 3. LF-4N/PI-1N 4. LF-9C 5. LF-4N/PI-13N 6. LF-3C (LF-4N/PI-1N and LF-9C - fourth and third respectively under revised factor rankings)	LF-1E/PI-27E "Siting option LF-1E/PI-27E was most favoured because it had the lowest site, site vicinity, community, regional and access road impact potential. The industrial designation of site PI-27E and its close proximity to an existing mix of heavy and light industrial uses strongly influenced the preference for this option. Agriculturally, it is more desirable to place the industrial facilities (incinerator and physical/chemical plant) on an industrial site away from active agriculture" (p.163). LF-1E "Option LF-1E was next preferred because of low impact potential in the site vicinity/community regional and access road factors. The site would be in a relatively unstable agricultural area where many small scale hobby farms and non-agricultural activities occur" (p.163). LF-9C/LF-4N/PI-1N "Siting options LF-9C and LF-4N/PI-1N were closely ranked. Site LF-9C was less preferred because it has higher vicinity, community and regional impact potentials" (p.164). LF-3C/LF-4N/PI-13N There was a relatively small separation between LF-3C and LF-4N/PI-13N, as well. The contrast between the two was that LF-4N/PI-13N as an option with two sites (larger size) but situated in a less stable agricultural community. The least preferred of the two was LF-3C" (p.164).	LF-1E/PI-27E 48/48[2] LF-1E 55/57[2] LF-4N/PI-1N 80/80 LF-9C 83/79[2] LF-4N/PI-13N 91/91 LF-3C 100/100 LF-1E/PI-27E - "Much more suitable than LF-4N/PI-1N and slightly better than LF-1E; PI is situated on designated industrial lands, not on rural land as is LF-1E" (p.162). LF-1E - "Much more suitable than LF-4N/PI-1N; slightly less favourable than LF-1E/PI-27E; site vicinity and community/regional impacts could be moderately low" (p.163). LF-4N/PI-1N - "Slightly better siting option than LF-9C; most impacts are moderate" (p.162). LF-9C - "Low on-site impacts due to small site size; but high vicinity and community impacts" (p.162). LF-4N/PI-13N "Slightly better siting option than LF-3C due primarily to lower access road impacts" (p.162). LF-3C - "Poorest siting option; high on-site, vicinity, community and access road impacts" (p.162). "The only difference resulting from use of the initial factor rankings is that option LF-9C is slightly more favoured than option LF-4N/PI-1N" (p.166).	"...it was the opinion of the agricultural consultant that none of the agricultural factors and none of the data relevant to the siting options warranted exclusion of a site on the basis of agricultural considerations alone. No regulations, standards, criteria or guidelines exist which establish relevant thresholds that can be directly applied. Of significance, indirectly, are air emission and groundwater standards which, complied with, will protect agricultural resources. Also, as noted in the Phase 3B "Agricultural" report (Ecologistics Limited and Deloitte, Haskins and Sells Associates, 1984) the "Foodland Guidelines, A Policy Statement of the Government of Ontario on Planning for Agriculture", (Government of Ontario, 1978) do not preclude the siting of such facilities in an agricultural area" (p.115). "It is also significant to note that the highest priority agricultural lands, i.e. the tender fruit growing areas of the Niagara Peninsula and other market gardening areas were excluded as potential sites at an early stage in the site selection process" (p.115).

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[1] The points on this table should be read column-by-column by discipline, rather than left to right on a point-by-point basis.

[2] "Initial factor rankings/revised factor rankings"

TABLE D.2

Summary - Rationale, Magnitude and Significance of Impact Rankings by Discipline[1]

CONSULTANT	RANKINGS	RATIONALE FOR RANKINGS	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
AGRICULTURE (Ecologistics Ltd.)	1. LF-1E/PI-27E 2. LF-1E 3. LF-4N/PI-1N 4. LF-9C 5. LF-4N/PI-13N 6. LF-3C (LF-4N/PI-1N and LF-9C - fourth and third respectively under revised factor rankings)	original versus revised factor rankings (base case) "As discussed earlier in the chapter, the initial factor rankings established by the agricultural consultant were amended as a result of input from the public workshops. ....The only difference resulting from use of the initial factor rankings is that option LF-9C is slightly more favoured than option LF-4N/PI-1N" (pp.164 and 166).		

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[1] The points on this table should be read column-by-column by discipline, rather than left to right on a point-by-point basis.

[2] "Initial factor rankings/revised factor rankings"

TABLE D.2

Summary - Rationale, Magnitude and Significance of Impact Rankings by Discipline[1]

CONSULTANT	RANKINGS	RATIONALE FOR RANKINGS	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
RESTRAINTS TO DISPERSION AND EXISTING AND ANTICIPATED AIR QUALITY (Ontario Research Foundation) References from: Ontario Research Foundation. 1985. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Atmospheric Conditions	LF-3C and LF-9C LF-1E LF-4N/PI-13N LF-4N/PI-1N LF-1E/PI-27E	Reflected in weighted suitability levels for the siting options - impact factors. LF-3C -2.0 LF-9C -2.0 LF-1E -2.4 LF-4N/PI-13N -2.6 LF-4N/PI-1N -2.7 LF-1E/PI-27E -3.4 LF-3C and LF-9C "The West Lincoln sites (LF-3C and LF-9C) are equally preferred in terms of general air quality impacts and atmospheric dispersion conditions" (p.72). Least restraints to dispersion (-1.0). Lowest existing and anticipated air quality (-2.1 - LF-3C and -2.2 - LF-9C). LF-1E Least restraints to dispersion (-1.0). Intermediate existing and anticipated air quality (-2.6). LF-4N/PI-13N Intermediate restraints to dispersion (-3.0). Intermediate existing and anticipated air quality (-2.5). LF-4N/PI-1N Greatest restraints to dispersion (-5.0). Intermediate existing and anticipated air quality (-2.4). LF-1E/PI-27E Least restraints to dispersion (-1.0). Most constrained - existing and anticipated air quality (-3.7).	As reflected in suitability levels: o LF-3C and LF-9C ranked at same levels; o moderate gap between LF-3C/LF-9C and LF-1E; o relatively limited gap between LF-1E and LF-4N/PI-13N; o slight difference between LF-4N/PI-13N and LF-4N/PI-1N; o more substantial gap between LF-4N/PI-1N and LF-1E/PI-27E.	"Air quality impact indicators have been assigned relatively low weightings due to the small incremental effects on ambient air quality which are likely to result from the facility emissions. On an annual average basis, these are 1% or less for the incinerator stack emissions, and 10% or less for fugitive emissions (based on existing and projected levels of SO_2, NO_x, TSP and THC - see Appendix C). In addition, another report (e.g Monenco, 1985) indicates that incinerator emissions will be well within ambient standards and guidelines for half-hour average concentrations. For most contaminants, such emissions would be less than 1% of the corresponding standards and guidelines. Sites having significant restraints to dispersion have been avoided at an earlier stage in the OWMC site selection process, (e.g. near the Niagara Escarpment or the Great Lakes) (ORF, 1983). Thus, none of the candidate sites is expected to experience significant higher levels of air pollution or increased frequencies of such episodes due to local topographic or meteorological influences. Some potential for wind channelling and effects on atmospheric turbulence have been identified at sites LF-4N and PI-1N. However, the severity of any effects on air quality is considered minor, and this conclusion has been verified by sensitivity analyses (see Chapter 6). The factor and indicator dealing with restraints to dispersion has therefore been assigned a weighting of 1. Indicators which address existing air quality are given a somewhat higher weighting of 3. Although the incremental effect on local air quality due to the OWMC facility would be small, the existence of polluting industries in the vicinity of the candidate sites was considered a potential constraint in the future operations of OWMC, should an airshed

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[2] "Initial factor rankings/revised factor rankings"

TABLE D.2

Summary - Rationale, Magnitude and Significance of Impact Rankings by Discipline[1]

CONSULTANT	RANKINGS	RATIONALE FOR RANKINGS	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
RESTRAINTS TO DISPERSION AND EXISTING AND ANTICIPATED AIR QUALITY (Ontario Research Foundation)	LF-3C and LF-9C LF-1E LF-4N/PI-13N LF-4N/PI-1N LF-1E/PI-27E	LF-1E/PI-27E Lowest ranking for LF-1E/PI-27E a reflection of much higher ranking for existing and anticipated air quality indicators.		management program be introduced for the affected area. This was a particular concern at the sites in Niagara Falls (LF-1E and PI-27E)" (p.64).

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[2] "Initial factor rankings/revised factor rankings"

TABLE D.2

Summary - Rationale, Magnitude and Significance of Impact Rankings by Discipline[1]

CONSULTANT	RANKINGS	RATIONALE FOR RANKINGS	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
BIOLOGY (Gartner Lee Associates Ltd.) References from: Gartner Lee Associates Ltd. 1985a. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Biology	LF-4N/PI-1N LF-9C LF-4N/PI-13N LF-3C LF-1E LF-1E/PI-27E	LF-4N/PI-1N Preferred option from site and site vicinity perspective, access road has potential for impact though on balance LF-9C and LF-4N/PI-13N have similar impact potential (p.131). LF-9C Higher potential rare species impact on-site than LF-4N/PI-1N, otherwise similar site and site vicinity impact potential, access road impacts potentially lower than for LF-4N/PI-1N and LF-4N/PI-13N. Little overall difference between this option and LF-4N/PI-1N and LF-4N/PI-13N (p.131) LF-4N/PI-13N Site and access road impact potential simiar to that associated with LF-4N/PI-1N. Higher site vicinity impact potential than for LF-9C, because of other natural vegetation and rare species in vicinity of LF-4N/PI-13N (p.131). LF-3C Somewhat higher site and site vicinity potential impacts than for previous three options. Much natural vegetation displaced on-site and many rare species known from the site vicinity. Access road constraint potentially less than for northern options (p.131). LF-1E Similar potential impact as for LF-3C.	A. LF-4N/PI-1N LF-9C LF-4N/PI-13N B. LF-3C LF-1E C. LF-1E/PI-27E "Siting options were grouped because it was difficult to distinguish differences in potential impact associated with several siting options. Ranking of options was confirmed by differences in siting option preference within the study areas of two options. For example, although the LF-4N/PI-13N site is preferred to that of LF-9C, the LF-9C site vicinity is preferred to that of LF-4N/PI-13N. Differences in potential for impact among Group A and Group C are clear. Although the options have been ordered within the first two groups, differences among options within the groups are slight. Differences between LF-4N/PI-13N in Group A and members of Group B are slight. LF-1E/PI-27E is definitely the least preferred of all options from a biological perspective" (p.130).	"A review of the Phase 4A data set (Table 13) revealed no evidence of occurrences which would indicate that any of the site or site vicinity study areas are unacceptable for OWMC facility siting from a biology perspective" (pp.78 and 80).

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[2] "Initial factor rankings/revised factor rankings"

TABLE D.2

Summary - Rationale, Magnitude and Significance of Impact Rankings by Discipline[1]

CONSULTANT	RANKINGS	RATIONALE FOR RANKINGS	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
BIOLOGY (Gartner Lee Associates Ltd.)	LF-4N/PI-1N LF-9C LF-4N/PI-13N LF-3C LF-1E LF-1E/PI-27E	LF-1E Access route impact potential is lower than for preceding options (p.132). LF-1E/PI-27E Least preferred site and site vicinity Potential impacts on site vegetation displaced, rare species, and on natural environment, SEUs, and woodlots surrounding LF-1E/PI-27E. Low access route potential impacts, however (p.132).		

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[2] "Initial factor rankings/revised factor rankings"

TABLE D.2

Summary - Rationale, Magnitude and Significance of Impact Rankings by Discipline[1]

CONSULTANT	RANKINGS	RATIONALE FOR RANKINGS	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
MUNICIPAL FINANCE (Clayton Research Associates Ltd.) References from: Clayton Research Associates Limited. 1985b. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Municipal Finance and Services Analysis	LF-9C LF-3C LF-1E LF-1E/PI-27E LF-4N/PI-1N LF-4N/PI-13N	LF-9C/LF-3C "Siting option LF-9C is ranked as the most preferred siting option for the municipal finance factor. OWMC facilities in this location have the lowest impact on area municipal operating costs, they generate the highest increase in revenue for the regional municipality and, next to siting option LF-3C, the loss of taxes due to negative property value impacts is the lowest among the siting options. Siting option LF-3C is very close in comparison and ranking in municipal finance impact to siting option LF-9C. The difference between the two West Lincoln siting options is the higher municipal operating costs associated with siting option LF-3C. The area and regional municipal mill rates, the lower burden of taxes, the lower levels of area municipal screening and the small area municipal tax base relative to the expected increase in area municipal revenues, all have a large influence on the ranking of the two West Lincoln siting options. The lower area municipal mill rates and burden of taxes reduces the negative property value impacts associated with OWMC facilities, while the lower levels of area municipal servicing reduces the negative impact on area municipal operating costs. The mill rate for regional municipal services results in a large increase in revenues for the regional municipality for both siting options in this Township. Finally, the increase in area municipal revenues resulting from OWMC facilities has a large relative impact on the area municipal tax base and, as a result, these siting options rank high with respect to the third indicator - net financial impact on area municipal tax rate. While the two West Lincoln siting options emerge as the most preferred in terms of municipal finance impacts, there are other, more qualitative considerations which should be	LF-9C 5.0 "Impact of payments in-lieu of taxes made by OWMC is large compared to municipal tax base. The financial impacts on operating costs of the area municipality are less because of lower levels of service. Negative property value impacts are lower because of fewer affected households and lower taxes" (p.91). LF-3C 4.9 As above for LF-9C. Slightly greater increase in operating costs than LF-9C because of greater regional maintenance costs on affected access roads (p.91). LF-1E 2.8 "Large increase in operating costs because of high levels of area municipal service. Revenue increases are high due to higher tax rates and greater anticipated household growth" (p.91). LF-1E/PI-27E 2.3 "As above for LF-1E. Option requires two sites, greater reduced property taxes due to negative property value impacts" (p.91). LF-4N/PI-1N 0.2 "Impact of payments in-lieu of taxes made by OWMC is much less because of unusual municipal tax levy situation.	"As discussed in Chapter 2, the total net municipal finance impacts of OWMC facilities in the three area municipalities would be positive for each siting option. However, except for payments in-lieu, the impact of these facilities on area municipal revenues would not be large. The negative impacts on operating costs are offset by revenue increases for all three area municipalities. The Region of Halton would experience a negative net financial impact for both Milton siting options; but in comparison to the total regional municipality budget, the negative impact would be very small. The Region of Niagara would experience a small positive net financial impact form the location of OWMC facilities in either West Lincoln or Niagara Falls. Since all net municipal finance impacts from OWMC facilities are either positive or negative and small in absolute terms, all of the candidate siting options meet basic acceptability criteria for this factor" (p.69).

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[2] "Initial factor rankings/revised factor rankings"

TABLE D.2

Summary - Rationale, Magnitude and Significance of Impact Rankings by Discipline[1]

CONSULTANT	RANKINGS	RATIONALE FOR RANKINGS	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
MUNICIPAL FINANCE (Clayton Research Associates Ltd.)	LF-9C LF-3C LF-1E LF-1E/PI-27E LF-4N/PI-1N LF-4N/PI-13N	LF-9C/LF-3C considered. First, there is the concern of Township officials that all costs for municipal capital works and projects associated with OWMC facilities will not in fact be borne by OWMC. If this proves to be the case, the Township, due to its small tax base, could be negatively impacted by the location of these Facilities in the Township. Second, there is a concern that incremental costs have not been considered in the calculation of area municipal finance impacts. Township officials are concerned that permanent staffing may be required for the fire station (rather than on a voluntary basis) and that additional services such as planning and engineering may be required, which will not be covered by OWMC. If this occurs, the positive municipal finance impacts determined in the above analysis for West Lincoln would decrease" (pp.90-93). LF-1E/LF-1E/PI-27E "The two Niagara Falls siting options, LF-1E and LF-1E/PI-27E, were ranked as the third and fourth preferred siting options, respectively, for the municipal finance factor. The lower ranking for siting option LF-1E/PI-27E is due to the higher costs associated with a dual siting option (through the requirement for more access roads and through greater negative property value impacts), as opposed to the requirement for only one site with siting option LF-1E. The lower ranking of the Niagara Falls siting options relative to the two siting options in West Lincoln is largely explained by three impacts: first, there is a much lower increase in regional municipal revenues associated with the Niagara Falls siting options; second, the increase in area municipal operating costs are higher in Niagara Falls than in West Lincoln; and third, the relative impact on the area municipal tax rate is much lower in Niagara Falls. The lower increase in regional	LF-4N/PI-1N 0.2 Option requires two sites, greater reduced property taxes due to negative property value impacts" (p.91). LF-4N/PI-13N 0.2 As above for LF-4N/PI-1N. "Slightly higher operating costs than LF-4N/PI-1N because of higher regional maintenance costs on affected access roads" (p.91).	

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[2] "Initial factor rankings/revised factor rankings"

TABLE D.2

Summary - Rationale, Magnitude and Significance of Impact Rankings by Discipline[1]

CONSULTANT	RANKINGS	RATIONALE FOR RANKINGS	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
MUNICIPAL FINANCE (Clayton Research Associates Ltd.)	LF-9C LF-3C LF-1E LF-1E/PI-27E LF-4N/PI-1N LF-4N/PI-13N	LF-1E/LF-1E/PI-27E municipal revenues is explained by the lower regional mill rate in Niagara Falls. The higher area municipal operating costs are a consequence of the higher level of area municipal servicing in Niagara Falls. And finally, the lower relative impact on the area municipal tax rate is explained by the larger size of the municipal tax base in Niagara Falls" (p.93). LF-4N/PI-1N/LF-4N/PI-13N "The two Milton sites, LF-4N/PI-1N and LF-4N/PI-13N are ranked as the two least preferred siting options in terms of municipal finance impacts. The low ranking of these siting options is explained more by the method of market value assessment employed in Milton than it is by municipal cost factors. Under the assessment methods applied in Milton, the payments in-lieu of taxes made by OWMC to Milton would be about half the amount paid to the other two municipalities. If not for this quirk in the tax system, the two siting options in Milton would be more closely ranked with the two Niagara Falls siting options. Beyond the strict financial analysis employed in this comparative evaluation, Milton officials raised additional cost considerations. The capacity of the sewage treatment plant in Milton is limited by the assimilation capacity of the receiving stream. In fact, there is current capacity for only about 2,000 additional people. Town officials expressed concern that either OWMC facilities or the resulting household growth could place additional strain on the Town's sewage treatment plant. Town officials also raised concerns over possible incremental costs (such as the ability of the existing fire department to service additional growth, staff time for inquiries, capital works projects, etc.) that might not be adequately compensated for through		

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[2] "Initial factor rankings/revised factor rankings"

TABLE D.2

Summary - Rationale, Magnitude and Significance of Impact Rankings by Discipline[1]

CONSULTANT	RANKINGS	RATIONALE FOR RANKINGS	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
MUNICIPAL FINANCE (Clayton Research Associates Ltd.)	LF-9C LF-3C LF-1E LF-1E/PI-27E LF-4N/PI-1N LF-4N/PI-13N	LF-4N/PI-1N/LF-4N/PI-13N the payments in-lieu of taxes made by OWMC. A further consideration when assessing Milton siting option LF-4N/PI-1N is the selection of candidate site PI-1N as a backup sanitary landfill site by the Region of Halton. The Region of Halton has undertaken costly studies to identify a preferred site for a new sanitary landfill operation. While PI-1N is not the preferred site selected by the Region of Halton, the possibility exists that the selected site may not be approved through the environment assessment process, in which case candidate site PI-1N would likely become the alternative choice for the regional sanitary landfill site. Should this occur, the impact on regional municipal costs in selecting this siting option for OWMC facilities would be much higher than estimated in this comparative evaluation process. As a result, LF-4N/PI-1N could be ranked lower in the final analysis than LF-4N/PI-13N" (pp.93-95).		

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TABLE D.2

Summary - Rationale, Magnitude and Significance of Impact Rankings by Discipline[1]

CONSULTANT	RANKINGS	RATIONALE FOR RANKINGS	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
ECONOMIC BASE (Clayton Research Associates Ltd.) References from: Clayton Research Associates Limited. 1985a. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Economic Base Analysis	LF-9C LF-1E LF-1E/PI-27E LF-3C LF-4N/PI-1N LF-4N/PI-13N No change when tourism, agriculture and business impacts combined.	LF-9C - Business Impacts (excluding agriculture and tourism) "Siting option LF-9C in West Lincoln is ranked as the most preferred siting option when all economic base factors considered in this report are ranked and aggregated. This siting option is characterized by very little economic activity which isn't agriculturally based (agricultural impacts are excluded from the economic base analysis). No businesses would be displaced by the location of OWMC facilities on this siting option and there are very few businesses within the site vicinity which would be either positively or negatively affected. Since there were very few measurable negative economic base impacts, the positive impact estimated by the community and regional economic base factor (i.e. new jobs created, employment growth and business perceptions of community economic impacts) was large enough to result in an overall positive impact and the highest ranking among the siting options" (p.107). LF-1E "Siting option LF-1E, unlike LF-9C, has measurable economic activity. There is a moderate displacement of business activity on-site and a moderate negative property value impact. These negative impacts were offset by a high positive impact estimate for the community and regional economic base factor. An important element which is excluded in the comparative evaluation of siting option LF-1E is the possible positive impacts of the facilities on business activity just outside the defined site vicinity study area (2 km from the centre of the site). If these businesses are included in the analysis (i.e., the Ford Motor Company glass plant, Cyanamid Inc. and B.F. Goodrich), the estimated positive economic base impact would be relatively large for LF-1E and it would become the most preferred siting option for economic base impacts by a wide margin" (p.108).	LF-9C 139 LF-1E 22 LF-1E/PI-27E 13 LF-3C -220 LF-4N/PI-1N -592 LF-4N/PI-13N -936 "Siting option LF-9C in West Lincoln and LF-1E and LF-1E/PI-27E in Niagara Falls are the only three siting options which are expected to have an overall positive impact on the economic base of the candidate municipalities" (p.107). "The two siting options in Niagara Falls, LF-1E and LF-1E/PI-27E, have virtually the same economic base impacts (in total). When all economic base factors are combined both are slightly positive" (p.108). "The major difference which separates the ranking of LF-3C from LF-9C is the inclusion of the Robert Land Military Academy under the business activity negatively affected by the presence of OWMC facilities factor" (p.109). Differences favouring LF-9C over LF-1E: o LF-1E more negative displacement of business activity; o more negative property value impacts; o more business activity negatively affected by the presence of OWMC facilities; o partially offset by more positive community and regional economic base (p.105). Differences favouring LF-3C over LF-4N/PI-1N: o LF-4N/PI-1N more negative displacement of business activity; o more negative property value impacts; o partially offset by more positive community and regional economic base (p.105.)	"Many of the impacts identified in the economic base analysis are positive impacts. The expected employment and household growth resulting from OWMC facilities will have a positive effect on the economies of the candidate municipalities. There are also a number of identified business operations in the candidate municipalities that will benefit from the services provided by OWMC facilities. The negative impacts include displacement of on-site businesses and negative impact on property values in the site vicinity. The displaced business will be compensated by OWMC and the negative impact on property values in the site vicinity can be ameliorated by a compensation package provided to affected property owners. A number of business operators contacted during the business survey anticipated that the presence of OWMC facilities in their vicinity would have a negative impact on business. These anticipated impacts could be reduced over time once OWMC facilities are in operation and become an accepted part of the local economy. Since all economic base impacts of OWMC facilities are expected to be small, all candidate siting options meet basic acceptability criteria for these factors" (p.71)

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[2] "Initial factor rankings/revised factor rankings"

TABLE D.2

Summary - Rationale, Magnitude and Significance of Impact Rankings by Discipline[1]

CONSULTANT	RANKINGS	RATIONALE FOR RANKINGS	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
ECONOMIC BASE (Clayton Research Associates Ltd.)	LF-9C LF-1E LF-1E/PI-27E LF-3C LF-4N/PI-1N LF-4N/PI-13N No change when tourism, agriculture and business impacts combined.	LF-1E/PI-27E "Siting option LF-1E/PI-27E, because it combines two sites, has much higher negative property value and displacement of business activity impacts than does integrated siting option LF-1E. Despite this, it is ranked very close to LF-1E because of the number of businesses within the site vicinity of PI-27E that would be positively affected by OWMC facilities (since the site vicinity of PI-27E includes the Ford Motor Company glass plant, Cyanamid Inc. and B.F. Goodrich). Possible industrial spinoffs (forward linkages), while excluded as a factor in the comparative evaluation process, are considered to be most likely for siting options LF-1E and LF-1E/PI-27E. Any spinoff industry would have both positive and negative impacts on the economic base which would have to enter into the overall impact assessment" (pp.108-109). LF-3C "Siting option LF-3C is similar to LF-9C in that the area economy is agriculturally based. As a result, negative impacts on property values are small, there is no displacement of business activity and the estimated positive impact on the community and regional economic base factor is moderate compared to other siting options. The major difference which separates the ranking of LF-3C from LF-9C is the inclusion of the Robert Land Military Academy under the business activity negatively affected by the presence of OWMC facilities factor. This school has a budget in excess of $1.1 million and has 42 employees and the negative impacts of OWMC facilities on this operation are sufficient to lower the ranking of this option to the fourth most preferred" (p.109).	Differences favouring LF-4N/PI-1N over LF-4N/PI-13N: o property value impacts; o business activity negatively affected by the presence of OWMC facilities. Combination of agriculture, business and tourism impacts. LF-9C -9.0 LF-1E -23.2 LF-1E/PI-27E -27.5 LF-3C -37.0 LF-4N/PI-1N -53.4 LF-4N/PI-13N -76.4 "In summary, the ranking of siting options for the composite of economic base impacts is the same as that determined in the economic base analysis conducted by Clayton Research Associates. The difference between the results of these two analyses is that siting option LF-9C becomes an even more preferred siting option in the composite economic base impact analysis" (Appendix E, p.13).	

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CONSULTANT	RANKINGS	RATIONALE FOR RANKINGS	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
ECONOMIC BASE (Clayton Research Associates Ltd.)	LF-9C LF-1E LF-1E/PI-27E LF-3C LF-4N/PI-1N LF-4N/PI-13N No change when tourism, agriculture and business impacts combined.	LF-4N/PI-1N/LF-4N/PI-13N "The overall economic base impacts of the two Milton siting options are strongly negative. Siting options LF-4N/PI-1N and LF-4N/PI-13N have large negative property value impacts (largely because two sites are required for those options) and a large negative impact on existing businesses (i.e., horse breeding and nursery orchard operations). One of the most important factors in the ranking of these siting options is the few businesses which are positively affected by the presence of OWMC facilities in Milton" (p.110). Combination - Agriculture, Tourism and Business Impacts LF-9C "The composite economic base impacts of OWMC facilities are estimated to be negative for each siting option. The lowest impact is estimated for siting option LF-9C in West Lincoln. While the estimated impact of this siting option on agriculture is quite high, there is no impact expected on tourism and the impact measured by the economic base component is positive. The positive economic base component impact associated with this site is explained by its low negative impact on businesses on-site and in the site vicinity which is more than offset by the positive impact measured by the community and regional economic base factor (i.e., new jobs created, household growth and business perceptions of community economic impacts)" (Appendix E, p.12). The economic base impacts of the two West Lincoln siting options would be altered if agricultural impacts were included in the analysis. Siting option LF-3C affects two farms on-site and 37 in the site vicinity; LF-9C also affects two farms on-site, but affects fewer farms, 30 in total, in the site vicinity. There are also impacts on the agricultural economy along access roads to OWMC		

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CONSULTANT	RANKINGS	RATIONALE FOR RANKINGS	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
ECONOMIC BASE (Clayton Research Associates Ltd.)	LF-9C LF-1E LF-1E/PI-27E LF-3C LF-4N/PI-1N LF-4N/PI-13N No change when tourism, agriculture and business impacts combined.	LF-9C facilities and in the Region from facilities emissions and possible stream contamination. It is also important to note that impacts on the agricultural economy would in turn affect service related firms, i.e., farm implement dealers and feed mills. The importance of the agriculture industry to the West Lincoln economy was noted in Chapter 3 Employment in agriculture accounts for 30.5% of the total employment in the Township. Due to the relatively small total population of the Township and the strong economic base reliance on agriculture, even a small impact on the agricultural industry would have an impact on the Township's economic base" (pp.107-108). LF-1E "The second most preferred siting option in the composite economic base impact analysis is siting option LF-1E. This siting option has a small estimated positive impact measured by the economic base component, but has a negative agriculture component impact (almost equal to that of LF-9C) and a negative impact on tourism. In the economic base analysis undertaken by Clayton Research Associates, the ranking of siting options LF-9C and LF-1E was closer than is the case when considering the negative agriculture and tourism impacts of OWMC facilities" (Appendix E, pp.12-13). "Any negative impacts on tourism employment would reduce the net number of employees and households generated by OWMC facilities. While this impact alone is unlikely to affect the ranking of siting options for economic base factors, it would likely result in the overall economic base impacts for the two Niagara Falls siting options being negative, as opposed to the positive impact derived in this economic base impact analysis" (p.109).		

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CONSULTANT	RANKINGS	RATIONALE FOR RANKINGS	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
ECONOMIC BASE (Clayton Research Associates Ltd.)	LF-9C LF-1E LF-1E/PI-27E LF-3C LF-4N/PI-1N LF-4N/PI-13N No change when tourism, agriculture and business impacts combined.	LF-1E/PI-27E "The other Niagara Falls siting option, LF-1E/PI-27E, is ranked as the third most preferred siting option for composite economic base impacts. This siting option is ranked very close to LF-1E, but is ranked lower due to higher negative tourism impacts" (Appendix E, pp.12-13). Comments re tourism same as LF-1E. LF-3C "Siting option LF-3C is ranked as the fourth most preferred siting option. This ranking is explained by a large negative impact for the agriculture component due to the relatively larger number of farms in the site vicinity. Also, in the economic base component, the presence of a private school in the site vicinity results in an overall negative impact. Siting option LF-3C is expected to have no impact on tourism in West Lincoln" (Appendix E, p.13). Comments re agriculture same as LF-9C. LF-1E/PI-1N/LF-4N/PI-13N "The two siting options in Milton are strongly negative for the composite economic base impacts of OWMC facilities. Both siting options have large negative property value impacts, a large negative impact on existing businesses and a large negative agriculture component impact. Both siting options also have a negative tourism impact" (Appendix E, p.13).		

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CONSULTANT	RANKINGS	RATIONALE FOR RANKINGS	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
LAND USE (Leon Kentridge Associates Ltd.) References from: Leon Kentridge Associates Ltd. 1985. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Land Use	LF-1E/PI-27E LF-1E LF-9C LF-4N/PI-1N and LF-3C LF-4N/PI-13N	LF-1E/PI-27E "The most significant positive attribute of this siting option is that site PI-27E is industrially designated in the draft Niagara Falls Official Plan. In addition, two major heavy industrial uses, the Ford Glass plant and the Cyanamid of Canada plant, are located in close proximity to this site, as are several other industrial uses. This is the only siting option which offers the opportunity for a high degree of land use compatibility both now and in the future, on the basis of the municipal official plan designation and adjacent heavy industrial land uses. The fact that the physical/chemical treatment plant and the incinerator, both heavy industrial in nature, will not be located in an agricultural area was a major consideration in the selection of this siting option. The second major positive attribute of this siting option is the excellent access to the Queen Elizabeth Way which results in a very short access road to a 400-series highway, and the minimal impacts on residential uses resulting from truck traffic to this siting option. Another positive attribute of this site is the high percentage of existing and future industrial lands within the community and regional area, which are designated in the official plan. In addition, relative to the West Lincoln sites, LF-3C and LF-9C, this area exhibits a lower level of land stability as evidenced by the high percentage of absentee land ownership. The major constraint associated with this siting option is the number of residences which will be displaced by this facility (15, the second highest of all siting options) and the number of residences located in the site	LF-1E/PI-27E -2.42 LF-1E -2.89 LF-9C -2.91 LF-4N/PI-1N -3.23 LF-3C -3.03 LF-4N/PI-13N -3.47 "The magnitude of difference in preference between these siting options is reflected in the overall Suitability Ratings in Table 8.2. LF-1E/PI-27E is clearly preferred over all siting options, LF-4N/PI-13N is significantly less preferred than all other options, and the differences between the remaining siting options are less pronounced" (p.125). In the final ranking of siting options no distinction has been made between siting option LF-3C and LF-4N/PI-1N. "The comparison between LF-3C and LF-4N/PI-1N revealed several tradeoffs. In the quantitative analysis, LF-3C scored somewhat more suitable, primarily on the strength of few constraints, such as existing residential and community facilities on-site and in the site vicinity. LF-3C is preferred in three of the four study areas for the factor Existing Land Use (site, site vicinity and community and regional area), although the margin of preference is not substantial in any case. In the fourth study area, access roads, LF-4N/PI/1N is clearly preferred due to urban development in Vineland enroute to LF-3C. In terms of the Land Use Stability factor, there is a clear preference for LF-4N/PI-1N in both the site and site vicinity due to the high proportion of absentee owned lands, in contrast to the high level of land stability near LF-3C. Provincial Policies and Plans are applicable only to LF-4N/PI-1N, although they are not severely affected by the siting of facilities at either LF-4N or PI-1N. The preference,	"From a land use perspective, no instances were identified where the basic acceptability of a siting option is not being met. No direct conflicts were identified with the requirements of a federal or provincial agency in the land use planning field. In addition, most of the decisions taken in Phase 3B with respect to the elimination of lands considered unsuitable for facility siting ensured that sensitive land uses, such as residential were sufficiently removed from potential sites. It should be noted that for several siting options, facility siting would not conform to municipal official plans and zoning by-laws. While this became a significant consideration in the comparative analysis, it was determined not to represent a matter which contravenes basic acceptability. This conclusion was based upon the fact that no planning document could contemplate such a unique land use. In addition, while it is desirable that the facilities conform to local planning policies and zoning by-laws, where possible, OWMC's status as a Crown Corporation does not legally require it to do so" (pp.118-119).

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CONSULTANT	RANKINGS	RATIONALE FOR RANKINGS	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
LAND USE (Leon Kentridge Associates Ltd.)	LF-1E/PI-27E LF-1E LF-9C LF-4N/PI-1N and LF-3C LF-4N/PI-13N	**LF-1E/PI-27E** vicinity (286, second highest of all siting options. It should, however, be noted that the number of residences within close proximity of the sites is lower for this siting option than for both the Milton siting options. A portion of the site vicinity includes the community of Cooks Mills, which is reflected in the number of residences in the site vicinity" (p.134-135). **LF-1E** "Siting option LF-1E was selected as the second most preferred siting option because it exhibited several of the same positive attributes as siting option LF-1E/PI-27E. Although this siting option does not allow the treatment facilities to be located on industrial lands, this site is located within 1 km of the lands at site PI-27E which are proposed to be designated industrial in the Niagara Falls Official Plan. Also, the site is 2.5 km from the Cyanamid plant and 3.0 km from the Ford Glass plant. As noted, the site enjoys excellent access to the Queen Elizabeth Way and, therefore, minimal impacts arising from truck traffic to this site are anticipated. In addition to the other reasons cited above for the ranking of LF-1E, this site has the following advantages over the other siting options of West Lincoln and Milton: o there is a lower level of land stability around LF-1E than either of the West Lincoln sites, indicated primarily by higher levels of absentee land ownership; o in the community and regional area, there is a very large land area devoted to heavy industrial uses, and designated in the municipal official plan for future industrial development;	nonetheless, is for LF-3C due to the absence of these constraints. In summary, the numerical advantages favouring LF-3C resulting from the quantitative analysis are largely offset in consideration of the future use of both siting options. Whereas, LF-3C is in a stable, agricultural community, LF-4N/PI-1N appears to be a transitional area in which the former agricultural land use pattern is becoming urbanized, as exemplified by the proposed landfill on LF-4N. Given the many tradeoffs mentioned above, it was concluded that no clear preference could be determined between the two siting options" (pp.132-133).	

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CONSULTANT	RANKINGS	RATIONALE FOR RANKINGS	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
LAND USE (Leon Kentridge Associates Ltd.)	LF-1E/PI-27E LF-1E LF-9C LF-4N/PI-1N and LF-3C LF-4N/PI-13N	LF-1E o in comparison to the Milton sites, there are fewer residences in close proximity to the siting options; o in comparison to the Milton sites, there is no potential for conflict with provincial planning policies, such as the Niagara Escarpment Plan and Parkway Belt Plan, which provide for public open space uses near sites LF-4N, PI-1N and PI-13N. The major constraint associated with siting option LF-1E is that it has the highest number of residences on-site which will be displaced. Siting option LF-1E is also not preferred to the West Lincoln and Milton siting options in the following respects: o a larger number of residences located in the site vicinity than LF-3C and LF-9C; o a larger number of vacant lots of record (indicating the potential for future development) than the Milton or West Lincoln siting options. On balance, however, these considerations were not considered significant enough to counter the advantages of LF-1E" (pp.135-136). LF-9C "This siting option was determined to be the third most preferred siting option. The major considerations in this ranking are outlined below. Relative to LF-3C, the other West Lincoln option, no significant difference was evident for the factors Planned and Proposed Land Use, Provincial Policies and Plans, and Land Use Stability. The only significant difference is the number of residences on each site, in the site vicinity and along the access roads to each site.		

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LAND USE (Leon Kentridge Associates Ltd.)	LF-1E/PI-27E LF-1E LF-9C LF-4N/PI-1N and LF-3C LF-4N/PI-13N	LF-9C In all of these cases, LF-9C is preferred. When compared to the two Niagara Falls siting options, LF-9C was determined to be less preferred, primarily due to the industrial nature of the Niagara Falls sites, the excellent accessibility available to LF-1E and PI-27E, and the major impacts associated with the access route to LF-9C, particularly in traversing the Vineland urban area. When compared to the two Milton siting options, it was concluded that this siting option is preferred to both LF-4N/PI-1N and LF-4N/PI-13N. The reasons for this are: o in an examination of the number of residences in the site and site vicinity, there are more residences at the Milton sites than LF-9C. As the dislocation and disruption of residents is one of the prime concerns of OWMC and the magnitude of difference is significant, this was a major consideration in the preference of LF-9C over both LF-4N/PI-1N and LF-4N/PI-13N. o in the community and regional study area, there is a much lower potential for impact on existing and future residential uses around LF-9C than the two Milton siting options. o the absence of conflict with the identified provincial planning policies in the case of LF-9C. The major similarity between LF-9C and the Milton siting options is the basic land use compatibility issue of locating these facilities in an agricultural area. The significant areas in which a preference for the Milton siting options is evident are the number of residences impacted along access routes, and in the lower level of land use stability in the Milton area" (pp.137-138).		

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CONSULTANT	RANKINGS	RATIONALE FOR RANKINGS	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
LAND USE (Leon Kentridge Associates Ltd.)	LF-1E/PI-27E LF-1E LF-9C LF-4N/PI-1N and LF-3C LF-4N/PI-13N	LF-3C "It was concluded that this siting option was the fourth most preferred siting option, together with LF-4N/PI-1N. The reason for this inability to select a preferred siting option from these siting options lies in the fact that, while there are major advantages and disadvantages to each, in the view of the land use consultant, these appear to balance each other. The major strengths of LF-3C in comparison to LF-4N/PI-1N are as follows: o fewer residences on-site and in the site vicinity; o less potential impact on residential use located in the community and regional area; o no impact on provincial planning policies. The strengths of LF-4N/PI-1N are as follows: o less impact to residences along local and regional access routes to the siting option; o LF-4N/PI-1N is located in a less stable agricultural area than LF-3C" (p.139). LF-4N/PI-1N "This siting option was determined to be the fourth most preferred siting option, together with LF-3C. When compared to siting option LF-4N/PI-13N, there was a clear preference for LF-4N/PI-1N for the following reasons: o significantly fewer residences in the site vicinity of LF-4N/PI-1N; o the situation of the two sites in relatively close proximity means that impacts on the Milton community will be restricted to a		

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LAND USE (Leon Kentridge Associates Ltd.)	LF-1E/PI-27E LF-1E LF-9C LF-4N/PI-1N and LF-3C LF-4N/PI-13N	LF-4N/PI-1N smaller geographic area. In a sense, LF-4N/PI-1N more closely resembles an integrated siting option than does the decentralized LF-4N/PI-13N; o less impact on residential uses along access routes to siting option LF-4N/PI-1N. Those areas in which there is a preference for LF-4N/PI-13N include provincial policies and plans and, marginally, land use stability Relative to the other siting options, this siting option is less preferred from the standpoint of number of residences in the site vicinity (LF-3C, LF-9C) and the lack of compatible industrial uses (LF-1E/PI-27E). Also, LF-4N/PI-1N is preferable to these siting options from the standpoint of land use stability, as evidenced by the high levels of absentee land ownership and land value trends" (p.138). LF-4N/PI-13N "This siting option was determined to be the least preferred siting option by the land use consultant. The reasons for this preference relative to each of the siting options have been outlined previously. However, to summarize, the following are the most significant disadvantages associated with this siting option: o LF-4N/PI-13N ranks last in terms of number of residences in close proximity to the site and in the total site vicinity; o the siting option ranks very low (fourth) in terms of number of residences on-site; o the site is located in an agricultural area with no industrial uses nearby" (pp.139-140);		

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SOCIAL (Institute of Environmental Research Inc.) References from: Institute of Environmental Research Ltd. 1985a. Site Selection Process. Phase 4A: Selection of a Preferred Site(s) - Social Analysis	LF-1E LF-1E/PI-27E LF-9C LF-4N/PI-1N LF-4N/PI-13N LF-3C	LF-1E o least number of residents whose daily activities and use and enjoyment of property both around the site and along the access roads (p.326); o site area not characterized by agriculture and rural development (p.326); o " in a municipality that is highly diverse, is home to a significant component of heavy industry, and has many other positive attributes" ... (p.328). Quantitative "LF-1E is the second most impacted in terms of displacement of residents and is the second most impacted in terms of social stability. Moderate levels of impact are identified for community and recreation features adjacent to the site, along the access route and social cohesion. LF-1E is the second least impacted in terms of community character and disruption of residents adjacent to the access route. It has the lowest potential impact for disruption of residents adjacent to and in the vicinity of the siting option and for disruption of features in the access route vicinity" (p.302). Social Stability - Qualitative "Although the two Niagara Falls sites have high degrees of social stability, and the stability of the local community (the 2 km study area) will be impacted, the effect on the larger municipality should be minimal. This is because Niagara Falls is a large, diversified urban municipality with considerable familiarity and experience with heavy industry. Also, while the local area (2 km study area) is a rural enclave within the larger municipality, it has been designated in part for transition to industrial use and so displacement of some residents and uses is anticipated in the normal course of events" (p.304).	Numerical Analysis LF-1E 3.649 LF-1E/PI-27E 4.250 LF-9C 4.548 LF-4N/PI-1N 5.058 LF-4N/PI-13N 5.423 LF-3C 5.552 Qualitative Adjustments "In terms of community character, it is one judgement that the greatest potential change will occur at the West Lincoln sites. With this in mind, we have assigned LF-3C and LF-9C a ranking of six (most impacted) for the community character factor"... When taking into account this qualitative assessment, the site option ranking does not change but the gaps between the siting options are modified. It reinforces the preference from a social impact perspective for the Niagara Falls sites and demonstrates that the West Lincoln sites are less preferred".	"To the best of our knowledge, there are no widely accepted standards which could be used and to judge the basic social acceptability of impacts associated with facilities of this kind. Therefore, it is necessary for us to rely on our judgement experience with other major projects and knowledge and similar kinds of facilities in other countries" (p.328). "Given that many factors are involved in the selection of the preferred site, we are confident that the social considerations have been approximately dealt with and that displacement and disruption has been minimized" (p.324). "While application of the social factors suggest the facility siting will represent additional nuisances, such as noise, dust and odour, in most cases these nuisances are minimal and should not lead to radical changes in lifestyle or behaviour patterns with serious social implications" (p.325).

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SOCIAL (Institute of Environmental Research Inc.)	LF-1E LF-1E/PI-27E LF-9C LF-4N/PI-1N LF-4N/PI-13N LF-3C	Social Cohesion ..."there is little doubt that new households will move into the Milton area to replace anyone moving out. Given the slow growth rates and the current economic conditions, the same cannot be as confidently predicted for Niagara Falls and West Lincoln. The interaction and interdependence amongst people in these areas can be affected more dramatically" (p.306). "Given the diversity of Niagara Falls and the roles of heavy industry and tourism in its economic development, the facility should not have any effects on the image and character of the broader community" (p.309). "It is our view that the more stable and slower growing municipalities (West Lincoln and Niagara Falls) will be more impacted in terms of social cohesion than a community like Milton that is undergoing change resulting from population growth" (p.306). "Given that: o the comparables study does not identify any impact; o the Laventhol and Horwath projection of tourism decline is short-lived; o the Falls is an international attraction and, with the ancillary attractions, will remain a powerful attractor of tourists; o the potential sites are about 5.5 km (PI-27E) and 8 km (LF-1E) from the Horseshoe Falls; o Niagara Falls and the Niagara Region are home to many heavy industries and have been so for a number of decades; o the PI-27E site is designated for industry and is adjacent to industry" (p.308). It is concluded that any impact on image related to tourism will be minimal and short-term" (p.308).		

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SOCIAL (Institute of Environmental Research Inc.)	LF-1E LF-1E/PI-27E LF-9C LF-4N/PI-1N LF-4N/PI-13N LF-3C	LF-1E/PI-27E o together with LF-1E least number of residents whose daily activities and use and enjoyment of property both around the site and along the access roads (p.326); o area not characterized by agriculture and rural development (p.326). o ...are in a municipality that is highly diverse, is home to a significant component of heavy industry, and has many other positive attributes"... (p.328). Quantitative Social Stability "This site is the most impacted in terms of displacement of residents, and has the highest potential impact on social stability and the disruption of community and recreation features adjacent to the site. It also has the lowest impact in terms of disruption of residents adjacent to the access route, features in the the access road vicinity, and community character. This siting option shows relatively lower impacts in terms of disruption of residents adjacent to the site and in the site vicinity" (p.301). Qualitative Social-Stability - (see LF-1E) Social Cohesion - (see LF-1E) Community Character - (see LF-1E)		

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Summary - Rationale, Magnitude and Significance of Impact Rankings by Discipline[1]

CONSULTANT	RANKINGS	RATIONALE FOR RANKINGS	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
SOCIAL (Institute of Environmental Research Inc.)	LF-1E LF-1E/PI-27E LF-9C LF-4N/PI-1N LF-4N/PI-13N LF-3C	LF-9C o area characterized by agriculture and rural development (p.326); o ..."possesses very little industry in the municipality and adjacent municipalities and are by and large agricultural in nature as well. Because of the dominance of agriculture and a farming lifestyle in West Lincoln, the intrusion of a heavy industrial would have a relatively greater impact on the image and character of the immediate surroundings and the municipality as well" (p.328); Quantitative "LF-9C has the second highest impact identified for disruption of residents adjacent to and in the vicinity of the access route, and is the third most impacted in terms of disruption of daily activities of residents in the vicinity of the site. More moderate impacts are identified for the disruption of daily activities of adjacent residents, disruption of operations of features adjacent to the site, along the access route and social stability. LF-9C is the least impacted siting option in terms of displacement of residents, social cohesion and disruption of community and recreation features in the site vicinity" (p.301). Social Stability "The introduction of a major industrial facility into a predominantly rural/agricultural area can have a substantial effect on stability because the changes it would bring will not necessarily be in tune with municipal objectives" (p.305). Social Cohesion ..."there is little doubt that new households will move into the Milton area to replace anyone moving out. Given the slow growth rates		

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[1] The points on this table should be read column-by-column by discipline, rather than left to right on a point-by-point basis.
[2] "Initial factor rankings/revised factor rankings"

TABLE D.2

Summary - Rationale, Magnitude and Significance of Impact Rankings by Discipline[1]

CONSULTANT	RANKINGS	RATIONALE FOR RANKINGS	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
SOCIAL (Institute of Environmental Research Inc.)	LF-1E LF-1E/PI-27E LF-9C LF-4N/PI-1N LF-4N/PI-13N LF-3C	Social Cohesion and the current economic conditions, the same cannot be as confidently predicted for Niagara Falls and West Lincoln. The interaction and interdependence amongst people in these areas can be affected more dramatically. The implications for disruption of social cohesion may also be more extensive in a rural agricultural area if the magnitude of disruption is such that the provision of facilities and services is affected. It is our view that the more stable and slower growing municipalities (West Lincoln and Niagara Falls) will be more impacted in terms of social cohesion than a community like Milton that is undergoing change resulting from population change (p.306). Community Character "Another aspect of the community character analysis is the introduction of a substantial heavy industrial facility into the midst of a rural agricultural community. Such a facility is incompatible with the image of a rural agricultural community which is characterized by a different environment, pace and lifestyles. It is our view that the impact on community character in West Lincoln may be greater than at the other sites because of the dominance of agriculture and a farming lifestyle in West Lincoln. The intrusion of a heavy industrial activity would clearly change the image and character of the immediate surroundings and the municipality as well" (p.308). LF-4N/PI-1N ...while predominantly agricultural in nature, are located in a changing area that is experiencing considerable growth as a result of commuters from both Hamilton and Toronto and		

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[1] The points on this table should be read column-by-column by discipline, rather than left to right on a point-by-point basis.
[2] "Initial factor rankings/revised factor rankings"

TABLE D.2

Summary - Rationale, Magnitude and Significance of Impact Rankings by Discipline[1]

CONSULTANT	RANKINGS	RATIONALE FOR RANKINGS	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
SOCIAL (Institute of Environmental Research Inc.)	LF-1E LF-1E/PI-27E LF-9C LF-4N/PI-1N LF-4N/PI-13N LF-3C	LF-4N/PI-1N likewise it is an area with new industrial development within the community" (p.328). Quantitative "Disruption of residents in the site vicinity is highest for this siting option and disruption of residents adjacent to the site is second highest. The impacts are second highest for the factors community and recreation features adjacent to and in the vicinity of the access route, and community and recreation features adjacent to the site. Community character of PI-1N/LF-4N is also the second most impacted of all the siting options. Lower levels of impact are shown for disruption of residents adjacent to and in the vicinity of the access routes, and community and recreation features in the site vicinity. This site option has the second lowest impact for social cohesion and the lowest impact for social stability" (pp.298 & 301). Social Stability "The Milton sites show considerably lower impacts on social stability. The fact that the area has undergone considerable change over past years has contributed to a less socially stable environment. The changes have increased population resulting from growth spilling over from Toronto and Hamilton, new industrial development in Milton, and conversion of farmland to urban areas. More change is to be expected as demonstrated by the future scenarios analysis which is documented in Appendix F" (p.305). Social Cohesion "Given that Milton is a desirable residential area, and the general growth pattern in the regions around Toronto, there is little doubt		

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[2] "Initial factor rankings/revised factor rankings"

TABLE D.2

Summary - Rationale, Magnitude and Significance of Impact Rankings by Discipline[1]

CONSULTANT	RANKINGS	RATIONALE FOR RANKINGS	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
SOCIAL (Institute of Environmental Research Inc.)	LF-1E LF-1E/PI-27E LF-9C LF-4N/PI-1N LF-4N/PI-13N LF-3C	Social Cohesion that new households will move into the Milton area to replace anyone moving out" (p.306). LF-4N/PI-13N ..."while predominantly agricultural in nature, are located in a changing area that is experiencing considerable growth as a result of commuters from both Hamilton and Toronto and likewise it is an area with new industrial development within the community" (p.328). Quantitative "Potential description of residents adjacent to the site, disruption of community and recreation features adjacent to the site and in the access route vicinity and effects on community character are the greatest for this siting option. The potential for disruption of residents in the site vicinity and disruption of community and recreation features adjacent to the access route are the second highest for this option. Lower levels of impacts are projected for the displacement of residents and disruption of the daily activities of residents adjacent to access routes, social stability and social cohesion" (p.298). Social Stability - (see LF-4N/PI-1N) Social Cohesion - (see LF-4N/PI-13N) LF-3C "...characterized by agriculture and rural development" (p.326). ...possesses very little industry in the municipality and adjacent municipalities are by and large agricultural in nature as well. Because of the dominance of agriculture and a		

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[1] The points on this table should be read column-by-column by discipline, rather than left to right on a point-by-point basis.
[2] "Initial factor rankings/revised factor rankings"

TABLE D.2

Summary - Rationale, Magnitude and Significance of Impact Rankings by Discipline[1]

CONSULTANT	RANKINGS	RATIONALE FOR RANKINGS	RELATIVE MAGNITUDE AND SIGNIFICANCE	ABSOLUTE MAGNITUDE AND SIGNIFICANCE
SOCIAL (Institute of Environmental Research Inc.)	LF-1E LF-1E/PI-27E LF-9C LF-4N/PI-1N LF-4N/PI-13N LF-3C	LF-3C farming lifestyle in West Lincoln, the intrusion of a heavy industrial activity would have a relatively greater impact on the image and character of the immediate surroundings and the municipality as well" (p.328). Quantitative "... potentially most impacted through disruption of the daily activities of residents adjacent to and in the vicinity of the access routes and disruption of community and recreation features in the site vicinity and adjacent to the access route. The impact on social cohesion is also the highest for LF-3C. Lower levels of impact are projected for displacement of residents, disruption of residents in the site vicinity and community character" (p.298). Social Stability - (see LF-9C) Social Cohesion (see LF-9C)		

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[1] The points on this table should be read column-by-column by discipline, rather than left to right on a point-by-point basis.
[2] "Initial factor rankings/revised factor rankings"

TABLE D.3

Risk Tradeoffs - LF-3C and LF-4N/PI-1N

	Risks

1. **Absolute Levels**	° both siting options basically acceptable
	° Hydrogeology
	  ° LF-4N/PI-1N - marginal in an absolute sense because of short contaminant breakthrough times
	  ° LF-3C - desirable in an absolute sense because of long contaminant breakthrough times
	° Transportation
	  ° no siting option marginal in absolute sense because range of annual spills (2.0 to 2.8) and annual accidents (5.3 to 8.3) comparatively narrow; range of spills posing a risk to human health (1 every 5.1 to 1 every 7.5 years) and the range of fatal or personal injury accident involvements (1.6 per year and 2.6 per year) too small to be statistically significant (total transport system)
	  ° although likelihood of spills/accidents extremely small, resources and other sensitive uses very close to edge of road through Vineland area
	° Surface Water
	  ° no siting option marginal
	    - floodplain constraint with Beaver Creek on candidate site LF-3C avoided through modified facility layout
	    - no sites with major sensitive water uses such as a municipal water intake (existing or planned) downstream

TABLE D.3

Risk Tradeoffs - LF-3C and LF-4N/PI-1N

	Risks
1. **Absolute Levels** (continued)	° Air ° no siting option marginal - chronic air emissions all acceptable risks with conservative assumptions - acute risks - potentially severe, but very low probability - direct conflict with major population concentrations avoided during previous stages ° Conclusion ° absolute risk greatest with hydrogeology pathway - favours LF-3C

TABLE D.3

Risk Tradeoffs - LF-3C and LF-4N/PI-1N

	Risks
2. **Relative Differences**	o Hydrogeology o strong preference for LF-3C - suitability levels 1 versus 5 for both natural containment and ground water use o Transportation o strong preference for LF-4N/PI-1N o aggregated value -55.4 versus -152.0 o Surface Water o preference for LF-4N/PI-1N o moderate difference (factor suitability level -3 versus -4) o moderate difference a reflection of greater flooding constraint o Air o clear preference for LF-3C o suitability level difference -2.2 versus -2.9 o much wider gap with alternative weighting scheme which places greater weight on direct pathways o Hydrogeology (natural containment) and transportation most highly ranked factors (level 10) o Air (direct exposure) almost as highly ranked (level 9) o Surface Water - not as highly ranked (level 7) for surface water use; major difference between options - flood susceptibility of LF-3C - a low ranked factor

TABLE D.3

Risk Tradeoffs - LF-3C and LF-4N/PI-1N

	Risks
	° Conclusion ° overall risk - major hydrogeology and moderate air differences considered (favouring LF-3C) sufficient to outweigh major transportation and surface water differences based on magnitude of differences and factor rankings

TABLE D.3

Risk Tradeoffs - LF-3C and LF-4N/PI-1N

	Risks
3. **Mitigation Potential**	° Hydrogeology ° natural containment and ground water use considered mitigable in short-term; not possible to ensure active engineering will maintain containment during post-closure period ° may not be possible to control water use even during operations period; not possible to control ground water use during post-closure period ° may be more difficult to institute and ensure effectiveness of mitigative measures with hydrogeologic pathway than with other pathways ° Transportation ° not possible to fully mitigate transportation risk, but possible to reduce transportation risk through a variety of means, e.g.: - vehicle design - driver training - road improvements - control of routing - control of timing of transport, e.g. time of day, weather conditions - contingency planning - control of amount of most hazardous material transported in a vehicle ° transportation risk during post-closure period not a concern ° some potential for route specific risk reduction measures with both options; mitigation more difficult with LF-3C ° Air ° mitigation of long-term air emissions not expected to be necessary; possible to reduce through operating procedures and design ° acute events (if a concern) can be largely mitigated through design, operations and contingency planning

TABLE D.3

Risk Tradeoffs - LF-3C and LF-4N/PI-1N

	Risks
3. **Mitigation Potential** (continued)	° Air (cont'd) ° possible that potential for some events so remote, i.e. multiple systems failure, that mitigation not considered warranted ° mitigation may not be possible for direct receptors; can be instituted for indirect receptors, e.g. ponds and cisterns; on this basis, LF-3C would be favoured, especially with alternative weighting scheme ° Surface Water ° on-site surface water release considered mitigable ° not possible to control (or to assume that can control) downstream use during operations period ° in unlikely event of surface water release, should be possible to institute appropriate contingency measures prior to human exposure/health effects ° flooding potential considered fully mitigable; mitigation more likely to be required at LF-3C ° potential for ground/surface water connections addressed by natural containment factor (which strongly favours LF-3C) ° options ranked at same level for surface water interference; can be expected to be no more difficult at one site than another to institute downstream mitigative measure ° Conclusion ° greatest general mitigation potential air and surface water pathways ° less mitigation potential transportation ° least long-term mitigation potential - hydrogeology ° based on mitigation potential, LF-3C would again tend to be favoured over LF-4N/PI-1N

TABLE D.3

Risk Tradeoffs - LF-3C and LF-4N/PI-1N

	Risks
4. **Uncertainty**	° Hydrogeology ° LF-3C - uniform predictability of geologic conditions ° greater uncertainty with LF-4N/PI-1N regarding ground water use because of greater potential for future ground water use ° general uncertainties in hydrogeologic analysis which would tend to favour a more conservative approach, i.e. site with longer breakthrough times and greater uniformity in predictability of geologic conditions - leachate characteristics will not be known with precision until facility has been operating for a period of years - detailed hydrogeologic conditions will not be known until after detailed drilling program (subsequent to selection of preferred sites) - difficult to predict long-term use and effectiveness of active engineering measures - difficult to predict and control long-term ground water use ° Transportation ° some general uncertainties regarding waste quantities and distribution; unless very major changes, not likely to affect estimates of probability of spills and accident to the extent change in: - relative ranking of options - general conclusions regarding range of differences (spills and accidents) across options - general and route-specific steps which might be taken to ameliorate transportation risk ° conservative assumptions re. transportation spills and accidents; unlikely that severity of risk underestimated ° somewhat greater uncertainty re accident and spill estimates on local and regional system, less historical traffic data available; estimates adequate for comparative evaluation purposes; favours LF-4N/PI-1N

TABLE D.3

Risk Tradeoffs - LF-3C and LF-4N/PI-1N

	Risks
4. **Uncertainty** (continued)	o Air o some uncertainties regarding emissions characteristics and synergistic effects o highly conservative emissions employed in generic risk assessment should ensure that both chronic and acute emissions (and related effects) will not be underestimated o possible to further reduce uncertainties through hazards/operations analysis, site-specific risk assessment and with design, operations and contingency planning refinements o somewhat greater uncertainties re. acute event predictions; more difficult to predict all major events and combinations of events; tends to reinforce preference for LF-3C o Surface Water o some limited uncertainties regarding flooding potential at LF-3C, although considered mitigable o downstream use more difficult to predict with precision or to control o high degree of certainty associated with mitigative measures o Conclusion o greatest degree of uncertainty with hydrogeologic pathway in general and with conditions at LF-4N/PI-1N in particular o some uncertainty re. flooding potential at LF-3C, but high degree of certainty re. mitigation potential o generally high degree of certainty regarding air and surface water pathways o uncertainties regarding transportation do not appear to affect analysis and (in terms of severity) are unlikely to have been underestimated o general and site-specific uncertainties reinforce preference for LF-3C

TABLE D.3

Risk Tradeoffs - LF-3C and LF-4N/PI-1N

	Risks
5. **Policy Implications**	° if LF-4N/PI-1N selected, would mean acceptance of marginal containment (short breakthrough times), limited dilution and uncertainty ° question of consistency with OWMC natural containment policy re. sand layers (assumption that further investigations would not result in rejection of site) ° if LF-4N/PI-1N selected, would also mean acceptance of high population exposure indices and relative greater downstream water uses ° if LF-3C selected, would mean acceptance of: - flooding potential uncertainty - relatively least desirable siting option for transportation risk - longest local and regional access road system - close proximity of residences and other sensitive uses to edge of road through Vineland ° Conclusion ° difficult risk policy implications with either option ° possibly slightly greater concern with LF-4N/PI-1N because of question of consistency with natural containment policy

APPENDIX E

(Appendix to Chapter 6)

APPENDIX E

INTRODUCTION

Appendix E was prepared by Clayton Research Associates Limited. The purpose of this appendix is to combine the estimated economic base impacts from the agriculture, tourism and economic base studies into an overall impact estimate for each siting option - referred to as the composite economic base impact analysis.

APPENDIX

ESTIMATE OF COMPOSITE ECONOMIC BASE IMPACTS

INTRODUCTION

The estimation of the potential impacts of OWMC facilities on the economic base of the candidate municipalities was divided among three members of the site selection team during Phase 4A of the Site Selection Process. Impacts on the agriculture economic base, along with a number of other agricultural impacts, were considered by Ecologistics Limited in Site Selection Process Phase 4A: Selection of a Preferred Site(s) - Agriculture. Impacts on the economic base associated with tourism were considered by Laventhol & Horwath and presented by Institute of Environmental Research Inc. in Site Selection Process Phase 4A: Selection of a Preferred Site(s) - Social Analysis, Appendices, Volume 4, Tourism Impacts and by J.B. Ellis and Associates presented by the Institute of Environmental Research Inc., Site Selection Process Phase 4A: Selection of a Preferred Site(s) - Social Analysis, Appendices, Volume 5, Comparative and Parallel Studies of Tourism Impact, 1985. Impacts on the more general economic base, including employment and households at the community and regional level and impacts on property values and businesses in the site vicinity, were considered by Clayton Research Associates in Site Selection Process Phase 4A: Selection of a Preferred Site(s) - Economic Base Analysis.

The purpose of this appendix is to combine the estimated economic base impacts from these studies into an overall impact estimate for each siting option - referred to here as the composite economic base impact analysis.

METHODOLOGY

A four step process has been adopted for the composite economic base impact analysis. The first step is the identification of relevant factors to be considered in the analysis. The second step comprises the scaling of these factors to a common scale, the weighting of the factors in terms of their importance of impact and then the aggregation of the weighted factor scores for each component of the analysis of economic base impacts (i.e., economic base, agriculture and tourism). The third step involves weighting the importance of each of the three components in terms of their impact on the overall economic base for each municipality under consideration. The fourth step aggregates the weighted component scores to obtain a composite estimate of economic base impacts for each siting option.

The economic base components referred to here correspond to the three source studies under consideration (economic base, agriculture and tourism). The use of these components to estimate the composite economic base impacts is preferred over the consideration of individual factors since the actual number of factors employed differs by component - which can bias the estimation. At the component level, this bias is eliminated.

IDENTIFICATION OF FACTORS

The factors used for estimating the composite economic base impacts of OWMC facilities, together with a description of each factor, are shown in Table 1. All five factors from the Phase 4A economic base impact analysis undertaken by Clayton Research Associates are included as are three agricultural factors from the Phase 4A analysis

TABLE 1

IDENTIFIED FACTORS FOR THE COMPOSITE ECONOMIC BASE IMPACT ANALYSIS

Study	Factor	Description
Clayton Research Associates, Site Selection Process Phase 4A: Selection of a Preferred Site(s) - Economic Base Analysis	Displacement of Business Activity	- This factor provides an estimate of all business activity (excluding farms) displaced on-site. The factor is estimated by number of businesses affected, number of employees and annual sales.
	Property Value Impacts	- This factor estimates the impact of OWMC facilities over a 1,500 metre zone surrounding each site (referred to as the site vicinity).
	Business Activity Positively Affected by the Presence of OWMC Facilities	- This factor relates to business activity in the site vicinity which could be positively affected by the presence of OWMC facilities. The factor is estimated by number of businesses affected, number of employees and annual sales.
	Business Activity Negatively Affected by the Presence of OWMC Facilities	- As above. However, this factor relates to business activity which could be negatively affected.
	Community and Regional Economic Base	- This factor estimates an overall economic base impact and is measured by number of jobs created, number of additional households created and perceptions of community economic impact.
Ecologistics Limited, Site Selection Process Phase 4A: Selection of a Preferred Site(s) - Agriculture	Displacement of Farms With On-Site Headquarters	- This factor provides an estimate of all farm activity displaced on-site. The factor is estimated by number of farm operations, average farm size and gross farm revenue.
	Partial Displacement of Farms With On-Site Land	- This factor provides an estimate of the impact of OWMC facilities on farms which are partially displaced. The factor is estimated by number of farm operations, average parcel size and proportion of land base lost.
	Disruption to the Farm Economy	- This factor provides an estimate of the possible impact of OWMC facilities on the productivity and sales of farms within a 5 kilometre zone of each siting option. The factor is estimated by gross farm revenue, relative exposure to fugitive emissions, relative exposure to stack emissions and by downstream livestock.
Laventhol & Horwath, see Institute of Environmental Research Inc., Site Selection Process Phase 4A: Selection of a Preferred Site(s) - Social Analysis, Appendices, Volume 4, Tourism Impacts, 1985.	Community Economic Base (Tourism)	- This factor provides an estimate of the possible impact of OWMC facilities on tourism in each candidate area municipality. This factor is estimated through qualitative considerations of possible changes in tourist visitations (and attendant impact on revenues and employment), possible impact on tourism-related development plans and possible impact on future development potential.
	Site Vicinity Economic Impacts (Tourism)	- This factor provides an estimate of possible impacts on tourism operations in the site vicinity (defined as a 2 kilometre zone around each siting option). This factor is measured by a possible reduction in tourist visitations, possible revenue impacts, impacts on scenic views and possible impacts on passing tourist traffic.

undertaken by Ecologistics Limited and two tourism impact factors from the Laventhol & Horwath Phase 4A analysis.

The factors considered during the comparative evaluation of candidate siting options in the composite economic base impact analysis include site specific factors (e.g., displacement of business and farm activity), site vicinity factors (e.g., property value impacts, partial displacement of farms and perceived impacts on tourism operations and business activity) and impacts which are community- or region-wide (e.g., community and regional economic base impacts, disruption to the farm economy and impacts on the tourism economy).

SCALING, WEIGHTING AND AGGREGATION OF FACTOR SCORES

In order to aggregate individual factor scores for each siting option, it is necessary that all factors be assigned a value on a common scale. Furthermore, since not all factors have the same importance in terms of composite economic base impacts, it is necessary to weight the factors prior to aggregating them. Both these procedures (together with the aggregation of factors at the component level) are undertaken in this section.

SCALING OF FACTORS

In the economic base, agriculture and tourism impact analyses undertaken by Clayton Research Associates, Ecologistics Limited and Laventhol & Horwath, respectively, each of the siting options is rated for comparison purposes against each factor. The scale used for comparison ranges from 0 to 5, and is referred to as the factor suitability level. The scale for any individual factor can be either positive or negative depending on the specific impacts estimated for the indicators of that factor (which can be either positive or negative).* The factor suitability levels for the factors from the Clayton Research Associates, Ecologistics Limited and Laventhol & Horwath studies are shown in Table 2.

WEIGHTING OF FACTORS

A weight for each factor, determining its importance relative to all other factors in the overall comparison of siting options, was established by M.M. Dillon and the site selection team consultants for the aggregation of all factors under consideration. The importance of each factor was rated on a scale ranging from 1 to 10. The weights assigned to each factor by M.M. Dillon and the site selection team are shown in Table 3. The rationale for the weights assigned to each factor in the comparative evaluation process are discussed in Appendix __ of this report. None of the factor weights have been changed in this appendix from those assigned by M.M. Dillon and the site selection team consultants since these weights appear reasonable for this analysis and provide a good estimate of the relative importance of each factor for aggregating factors at the component level.

AGGREGATION OF FACTOR SCORES

The weighted factor scores are aggregated on a component basis and are shown in Table 3. For the economic base component, there are both positive and negative impacts associated with OWMC facilities, resulting in the overall impact of this component being positive for three of the six siting options (LF-9C, LF-1E and LF-1E/PI-27E). The economic base impacts of the agriculture and tourism

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* A factor can have a number of indicators which measure both positive and negative impacts.

TABLE 2

FACTOR SUITABILITY LEVELS FOR COMPOSITE ECONOMIC BASE FACTORS

	Siting Option					
	Region of Niagara				Region of Halton	
	West Lincoln		Niagara Falls		Milton	
	LF-3C	LF-9C	LF-1E	LF-1E/ PI-27E	LF-4N/ PI-1N	LF-4N/ PI-13N
Economic Base*						
Displacement of Business Activity	0.0	0.0	-3.6	-5.0	-2.2	-1.2
Property Value Impacts	-1.2	-1.2	-1.8	-2.8	-3.9	-5.0
Business Actively Positively Affected by the Presence of OWMC Facilities	0.0	0.1	0.1	5.0	0.4	0.6
Business Actively Negatively Affected by the Presence of OWMC Facilities	-3.1	-0.7	-1.4	-3.3	-2.6	-5.0
Community and Regional Economic Base	2.0	2.4	4.5	5.0	2.6	2.6
Agriculture**						
Displacement of Farms With On-Site Headquarters	-4.9	-2.6	-3.9	-2.9	-2.3	-5.0
Partial Displacement of Farms With On-Site Land	-5.0	-2.3	-4.3	-3.6	-4.4	-3.0
Disruption to the Farm Economy	-4.5	-4.9	-1.5	-1.3	-3.5	-5.0
Tourism***						
Community Economic Base	0.0	0.0	-5.0	-5.0	-0.5	-0.5
Site Vicinity Economic Impacts	0.0	0.0	0.0	-1.0	-1.0	-0.5

* Factor suitability levels for these factors were obtained from a study by Clayton Research Associates, Site Selection Process Phase 4A: Selection of a Preferred Site(s) - Economic Base Analysis, 1985.

** Factor suitability levels for these factors were obtained from a study by Ecologistics Limited, Site Selection Process Phase 4A: Selection of a Preferred Site(s) - Agriculture, 1985.

*** Factor suitability levels for these factors were obtained from a study by Laventhol & Horwath, see Institute of Environmental Research Inc., Site Selection Process Phase 4A: Selection of a Preferred Site(s) - Social Analysis, Appendices, Volume 4, Tourism Impacts, 1985.

TABLE 3

AGGREGATION OF WEIGHTED FACTOR SCORES

		Siting Option					
		Region of Niagara				Region of Halton	
		West Lincoln		Niagara Falls		Milton	
	Weight	LF-3C	LF-9C	LF-1E	LF-1E/ PI-27E	LF-4N/ PI-1N	LF-4N/ PI-13N
Economic Base							
Displacement of Business Activity	4	0.0	0.0	-14.4	-20.0	-8.8	-4.8
Property Value Impacts	7	-8.4	-8.4	-12.6	-19.6	-27.3	-35.0
Business Activity Positively Affected by the Presence of OWMC Facilities	4	0.0	0.4	0.4	20.0	1.6	2.4
Business Activity Negatively Affected by the Presence of OWMC Facilities	6	-18.6	-4.2	-8.4	-19.8	-15.6	-30.0
Community and Regional Economic Base	8	16.0	19.2	36.0	40.0	20.8	20.8
Total		-11.0	7.0	1.0	0.6	-29.3	-46.6
Agriculture							
Displacement of Farms With On-Site Headquarters	6	-29.4	-15.6	-23.4	-17.4	-13.8	-30.0
Partial Displacement of Farms With On-Site Land	8	-40.0	-18.4	-34.4	-28.8	-35.2	-24.0
Disruption to the Farm Economy	8	-36.0	-39.2	-12.0	-10.4	-28.0	-40.0
Total		-105.4	-73.2	-69.8	-56.6	-77.0	-94.0
Tourism							
Community Economic Base	8	0.0	0.0	-40.0	-40.0	-4.0	-4.0
Site Vicinity Economic Impacts	6	0.0	0.0	0.0	-6.0	-6.0	-3.0
Total		0.0	0.0	-40.0	-46.0	-10.0	-7.0

components are negative or neutral and thus the aggregate factor scores for these components are either negative or zero.

The aggregate factor scores are transposed to a scale of 0 to 5 for each component to facilitate the aggregation of composite impacts. These scaled component scores are shown in Table 4.

TABLE 4

SCALED COMPONENT SCORES

	Siting Option					
	Region of Niagara				Region of Halton	
	West Lincoln		Niagara Falls		Milton	
Component	LF-3C	LF-9C	LF-1E	LF-1E/ PI-27E	LF-4N/ PI-1N	LF-4N/ PI-13N
Economic Base	-1.2	0.8	0.2	0.1	-3.1	-5.0
Agriculture	-5.0	-3.4	-3.3	-2.7	-3.7	-4.5
Tourism	0.0	0.0	-4.3	-5.0	-1.1	-0.8

ASSIGNMENT OF WEIGHTS TO COMPONENTS

To aggregate the component scores, a weight was assigned by Clayton Research Associates to each component, showing the importance of that component to the estimation of the composite economic base impact. A two step process has been adopted in this analysis for assigning component weights. In the first step, a weight is assigned to the overall economic base component (i.e., economic base 30, agriculture 15 and tourism 9). In the second step, differences in the relative impact of OWMC facilities on each economic base component in individual candidate municipalities are taken into account. This is done by distributing the component weight (i.e., agriculture 15) among candidate municipalities based on an estimate of the relative impact of OWMC facilities in each municipality. The distribution of component weights by candidate municipality is shown in Table 5. The rationale for the component weighting and distribution is provided on the following pages.

TABLE 5

COMPONENT WEIGHTS, BY MUNICIPALITY

	Candidate Municipality			
	Region of Niagara		Region of Halton	
Component Component	West Lincoln	Niagara Falls	Milton	Component Weight
Economic Base	10	10	10	30
Agriculture	6.8	2.8	5.4	15
Tourism	0.3	7.7	1.0	9

The economic base component is assigned a weight of 30 in this analysis. This component, of the three under consideration, covers the largest proportion of the composite economic base in each candidate municipality. The economic base component considers the employment impacts resulting from OWMC facilities on the economy of the candidate municipalities, the potential for spin-off industries resulting from OWMC facilities and the impact of OWMC facilities on businesses and properties both on-site and in the site vicinity. The impact of OWMC facilities on the economic base component is estimated to be larger than on the agriculture and tourism components, not only because these latter components comprise a proportionately smaller share of the total economy, but also because many of their negative impacts can be mitigated or are expected to be short-term (particularly tourism impacts). The employment impacts estimated by the economic base component, on the other hand, are longer-term.

The weight assigned to each candidate municipality for the economic base component is 10. Unlike the agriculture and tourism components, the net impact of OWMC facilities on the economic base component has been estimated for each candidate municipality in the Phase 4A work undertaken by Clayton Research Associates. Therefore, the importance of net impact (assigned weight) should not be varied by municipality since relative differences have previously been taken into account.

The agriculture component is assigned a weight of 15 in this analysis. The agriculture component accounts for a smaller proportion of the composite economic base than does the economic base component. In addition, the net impact of OWMC facilities on employment and income in agriculture is expected to be significantly less than the corresponding economic base component impact.

The weight assigned to each candidate municipality for the agriculture component varies due to estimated relative differences in impact. It is assumed that the impact on the agriculture economy will vary by the size of employment in that sector in each candidate municipality. Therefore, West Lincoln, with a relatively large number of employees in agriculture is assigned a weight of 6.8, Milton is assigned a weight of 5.4 and Niagara Falls, with much fewer agriculture employees, a weight of 2.8 (for a total of 15).

The weight assigned to the tourism component in this analysis is 9. This component, like the agriculture component, represents a smaller proportion of the composite economic base than does the economic base component. The estimates of negative impacts on the tourism economy range from zero for all siting options (J.B. Ellis and Associates) to significant for the Niagara Falls siting options (Laventhol & Horwath). Any negative impacts of OWMC facilities on the tourism economy in candidate municipalities appear to be short-term, unlike some of the impacts identified by the economic base and agriculture components. For these reasons, the tourism component is assigned a lower weight than either the economic base or agriculture components.

The weight assigned to each candidate municipality for the tourism component varies due to estimated relative differences in impact. It is assumed that the impact on the tourism economy will vary by the size of employment in that sector in each candidate municipality. Therefore, Niagara Falls, with a relatively large number of employees in tourism, is assigned a weight of 7.7, Milton is assigned a weight of 1.0, and West Lincoln, with few tourism employees, a weight of 0.3 (for a total of 9).

AGGREGATE WEIGHTED COMPONENT SCORES

By applying the assigned weights to the scaled value for each component by siting option, an aggregate weighted component score is obtained. These are shown in Table 6.

TABLE 6

AGGREGATE WEIGHTED COMPONENT SCORES

	Siting Option					
	Region of Niagara				Region of Halton	
	West Lincoln		Niagara Falls		Milton	
Component	LF-3C	LF-9C	LF-1E	LF-1E/ PI-27E	LF-4N/ PI-1N	LF-4N/ PI-13N
Economic Base	-12.0	8.0	2.0	1.0	-31.0	-50.0
Agriculture	-34.0	-23.1	-9.2	-7.6	-20.0	-24.3
Tourism	0.0	0.0	-33.1	-38.5	-1.1	-0.8
Total	-46.0	-15.1	-40.3	-45.1	-52.1	-75.1

The impact of OWMC facilities on the composite economic base of the candidate municipalities can be ranked by siting option utilizing these scores.

COMPARISON AND RANKING OF SITING OPTIONS

The ranking of siting options from the most preferred to the least preferred for composite economic base impacts is as follows:

LF-9C, West Lincoln
LF-1E, Niagara Falls
LF-1E/PI-27E, Niagara Falls
LF-3C, West Lincoln
LF-4N/PI-1N, Milton
LF-4N/PI-13N, Milton

The composite economic base impacts of OWMC facilities are estimated to be negative for each siting option. The lowest impact is estimated for siting option LF-9C in West Lincoln. While the estimated impact of this siting option on agriculture is relatively high, there is no impact expected on tourism and the impact measured by the economic base component is positive. The positive economic base component impact associated with this site is explained by its low negative impact on businesses on-site and in the site vicinity which is more than offset by the positive impact measured by the community and regional economic base factor (i.e., new jobs created, household growth and business perceptions of community economic impacts).

The second most preferred siting option in the composite economic base impact analysis is siting option LF-1E in Niagara Falls. It is ranked only slightly ahead of siting options LF-1E/PI-27E and LF-3C. This siting option has a small estimated positive impact measured by the economic base component, but has a negative agriculture component impact and a large negative impact on tourism. In the economic base analysis undertaken by Clayton Research Associates, the ranking of siting options LF-9C and LF-1E was closer than is the case when considering the negative agriculture and tourism impacts of OWMC facilities.

The other Niagara Falls siting option, LF-1E/PI-27E, is ranked as the third most preferred siting option for composite economic base impacts. This siting option is ranked close to LF-1E, but is ranked lower due to higher negative tourism impacts.

Siting option LF-3C in West Lincoln is ranked as the fourth most preferred siting option. This ranking is explained by a large negative impact for the agriculture component due to the relatively larger number of farms in the site vicinity. Also, in the economic base component, the presence of a private school in the site vicinity results in an overall negative impact. Siting option LF-3C is expected to have no impact on tourism in West Lincoln.

The two siting options in Milton are strongly negative for the composite economic base impacts of OWMC facilities. Both siting options have large negative property value impacts, a large negative impact on existing businesses and a large negative agriculture component impact. Both siting options also have a negative tourism impact.

In summary, the ranking of siting options for the composite of economic base impacts is the same as that determined in the economic base analysis conducted by Clayton Research Associates. The difference between the results of these two analyses is that siting option LF-9C becomes an even more preferred siting option in the composite economic base impact analysis.

APPENDIX F

(Appendix to Chapter 7)

1.0 INTRODUCTION

This Appendix:

1) reviews the individual consultants' inputs, specifies changes made to consultants' quantitative inputs and provides a rationale for these changes;

2) compares the rankings presented in Chapter 4 to those prepared by the individual consultants;

3) presents the results of the quantitative analysis (in tabular form) with and without adjustments for factor overlaps.

2.0 STANDARDIZATION OF CONSULTANTS' INPUTS

In the subsection which follows:

- potential sources of error and inconsistencies in individual consultants inputs' are identified;
- the changes made to standardize consultants' inputs are presented;
- a summary rationale for the changes made is presented.

2.1 RISK PATHWAYS

2.1.1 M.M.D. TRANSPORTATION

a) Review of Inputs

A statistical analysis undertaken by the transportation consultant (M.M. Dillon Ltd.) indicated that there is no statistically significant difference between some siting options based upon certain factors.

b) Changes

The differences indicated by the transportation factor suitability levels are considered to be significant for the purpose of the quantitative aggregation.

2.1.2. ORF AIR QUALITY

a) Review of Inputs

The ranking of siting options provided by the air quality consultant (ORF) was based on a set of scores. The scores for each option were calculated by dividing the sum of the weighted products of the indicator suitability levels by the sum of the weights assigned to the indicators. Thus, indicators were treated as the basic unit of comparison.

For risk from direct inhalation of emissions-acute, one indicator "topographic features on or around site" used ordinal data (i.e. numbers defining the siting option's relative position in a series). These data were interpreted as interval (i.e. real numbers indicating relative magnitude of difference between the values) data in the analysis.

b) **Changes**

M.M. Dillon aggregated information at the factor level. Weights were also applied at this level. The range of values for the FSLs is from a maximum of 0 to -5.0. The best option will have a value of 0. Table F.1 contains the changes made to ORF factor suitability levels.

c) **Rationale**

FSLs were adjusted to range from 0 to -5.0 and scaled relative to the lowest score among the siting options.

2.1.3 GLAL HYDROGEOLOGY

a) **Review of Inputs**

The interval between the factor suitability levels is based upon GLAL's judgement of the difference between options rather than a strictly measurable difference.

b) **Changes**

Capability of Providing Natural Containment.

	GLAL - Hydrogeology	Adjusted
LF-1E	-5.0	-4.0
LF-1E/PI-27E	-5.0	-4.0
LF-4N/PI-1N	-6.0	-5.0
LF-4N/PI-13N[1]	-	-6.0
LF-9C	-1.0	-1.0
LF-3C	-1.0	-1.0

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[1] Failed to provide natural containment; therefore no FSL assigned.

TABLE F.1

CHANGES MADE TO AIR QUALITY RISK

FACTOR SUITABILITY LEVELS

FACTORS	LF-3C		LF-9C		LF-1E		LF-1E/PI-27E		LF-4N/PI-1N		LF-4N/PI-13N	
	ORF	Adj.[1]	ORF	Adj.	ORF	Adj.	ORF	Adj.	ORF	Adj.	ORF	Adj.
Risks Direct Inhalation Emissions-Chronic	-1.0	-1.1	-1.2	-1.5	-2.4	-2.7	-4.4	-5.0	-3.6	-4.1	-4.2	-4.8
Risks Direct Inhalation Emissions-Acute	-1.7	-2.6	-1.9	-2.9	-2.5	-3.8	-2.7	-4.1	-3.3	-5.0	-3.2	-5.0
Risks Ingestion Cistern/Pond Water	-2.3	-2.3	-1.5	-1.5	-5.0	-5.0	-1.0	-1.0	-1.4	-1.4	-1.8	-1.8
Risks Consumption Crops & Livestock	-4.0	-5.0	-4.0	-5.0	-1.3	-1.7	-1.0	-1.3	-2.4	-3.1	-2.6	-3.2

[1] Adjusted by the Site Selection Consultant

c) Rationale

The FSLs were adjusted so that -5.0 is the minimum FSL applied to an option that is considered basically acceptable; -6.0 was applied to LF-4N/PI-13N because this option was not considered basically acceptable.

2.1.4. GLAL SURFACE WATER

a) Review of Inputs

Both ordinal and inverval scaling of data were used and subjective judgements were often made regarding the magnitude of differences between options in scaling the data.

For purposes of the quantitative analysis, all scaled data were assumed to be interval.

b) Changes

The High, Medium and Low indicator weights were assigned the following values, 3, 2 and 1, and these were multiplied by scaled values. The latter were assigned as shown below:

High	3
Medium	2
Low	1
Present	1
Absent	0

	Susceptibility to Flooding		Surface Water Use	
Siting Option	GLAL	Adjusted	GLAL	Adjusted
LF-9C	-1.0	-2.3	-3.0	-2.5
LF-3C	-5.0	-5.0	-3.0	-2.5
LF-1E	-1.0	-2.3	-1.0	-0.8
LF-1E/PI-27E	-2.0	-3.0	-1.0	-0.8
LF-4N/PI-1N	-3.0	-3.0	-3.0	-2.5
LF-4N/PI-13N	-3.0	-2.7	-5.0	-5.0

c) Rationale

A quantitative approach was applied to the factors and indicators. Indicators were assigned weights by the surface water consultant (GLAL, 1985c, Tables 21 and 22) and the data were scaled (High, Medium, Low, Present, Absent).[1]

2.2 IMPACT DISCIPLINES

2.2.1 IER SOCIAL

a) Review of Inputs

Ordinal data were used to assess community character and were assumed to be interval for the purposes of the analysis.

b) Changes

M.M. Dillon Ltd. developed factor suitability levels for the IER data. Those levels show the differences between siting options less precisely than do the IER scores for each factor and siting option. Factor scores produced by the social consultant were scaled and factor weights derived by M.M. Dillon were applied; this procedure resulted in a minor loss of information.

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[1] A sensitivity analysis was conducted to determine the sensitivity of siting option ranking to these changes. No change in overall ranking results from these adjustments.

The range of values for the FSLs is from a maximum of 0 to -5.0. The best option will have a value of 0. Table F.2 contains changes made to IER factor suitability levels.

c) Rationale

As no FSLs were developed by IER, the task was undertaken by M.M. Dillon using scores for each factor listed in Table 9.19 of the IER Social Analysis Report (IER, 1985a, p. 299).

2.2.2 LKA LAND USE

a) Review of Inputs

Indicator suitability levels were developed by LKA using subjective judgements of subindicator values. For some factors, the data are scaled using judgements regarding the relative difference between options rather than based upon numerical values.

b) Changes

"No occurrence" of residential and commercial features has been interpreted as positive impacts rather than "no impact" by LKA. No impact (or a "0" value) was assigned by other consultants in cases when there was no occurrence of a feature. Therefore, indicator values adjusted to make all "no occurrence" values for residential and commercial uses equal to zero (rather than -1).

The range of values for the FSLs is from a maximum of 0 to -5.0. The best option will have a value of 0. Table F.3 contains changes made to LKA factor suitability levels.

TABLE F.2

Changes Made to IER (Social Analysis) Numerical Analysis

FACTOR GROUPINGS/FACTORS	SITING OPTIONS											
	PI-13N/ LF-4N		PI-1N/ LF-4N		PI-27E/ LF-1E		LF-1E		LF-3C		LF-9C	
	IER VALUE	FSL[1]	IER VALUE	FSL	IER VALUE	FSL	IER VALUE	FSL	IER VALUE	FSL	IER VALUE	FSL
Impacts on Residents												
Displacement	0.707	-3.1	0.709	-3.1	1.138	-5.0	1.102	-4.0	0.595	-2.6	0.301	-1.3
Disruption of Daily Activities												
- Adjacent to Site	1.500	-5.0	1.302	-4.3	0.618	-2.1	0.394	-1.3	1.029	-3.4	0.732	-2.4
- Site Vicinity	0.825	-5.0	0.828	-5.0	0.597	-3.6	0.449	-2.7	0.460	-2.8	0.789	-4.8
- Adjacent to Access Route	0.304	-1.9	0.338	-2.1	0.007	-0.1	0.012	-0.1	0.800	-5.0	0.623	-3.9
- Access Route Vicinity	0.160	-1.3	0.149	-1.2	0.012	-0.1	0.012	-0.1	0.600	-5.0	0.534	-4.5
Impacts on Community and Recreation Features												
Displacement	0.163	-4.0	0.200	-5.0	-	-	-	-	-	-	-	-
Disruption of Operations												
- Adjacent to Site	0.125	-5.0	0.063	-2.5	0.125	-5.0	-	-	-	-	-	-
- Site Vicinity	0.092	-2.8	0.086	-2.7	0.130	-4.0	0.055	-1.7	0.162	-5.0	0.009	-0.3
- Adjacent to Access Route	0.123	-4.1	0.123	-4.1	0.003	-0.1	0.003	-0.1	0.150	-5.0	0.106	-3.5
- Access Route Vicinity	0.099	-5.0	0.090	-4.6	0.006	-0.3	0.006	-0.3	0.090	-4.6	0.068	-3.4
Community and Region												
Social Stability	0.490	-3.4	0.482	-3.4	0.718	-5.0	0.696	-4.9	0.647	-4.5	0.608	-4.2
Social Cohesion	0.223	-3.4	0.141	-2.2	0.302	-4.6	0.301	-4.6	0.328	-5.0	0.062	-1.0
Community Character	0.775	-5.0	0.747	-4.8	0.594	-3.8	0.619	-4.0	0.691	-4.5	0.716	-4.6

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[1] Factor suitability level developed by the site selection consultant.

TABLE F.3

Changes Made to LKA (Land Use) Factor Suitability Levels

SITING OPTIONS

FACTOR/STUDY AREA	LF-3C		LF-9C		LF-1E		LF-4N/ PI-1N		LF-4N/ PI-13N		LF-1E/ PI-27E	
	LKA	ADJ.[1]	LKA VALUE	ADJ.	LKA VALUE	ADJ.	LKA VALUE	ADJ.	LKA VALUE	ADJ.	LKA VALUE	ADJ.
1. Existing Land Use												
. Site Area	-1.6	-1.5	-1.0	-0.7	-4.0	-4.7	-2.3	-2.6	-2.3	-2.6	-4.3	-5.0
. Site Vicinity	-2.0	-2.1	-1.9	-2.0	-3.4	-3.6	-3.1	-3.3	-4.7	-5.0	-3.3	-3.6
. Community & Regional Area	-2.0	-3.3	-2.0	-3.3	-1.0	-1.7	-3.0	-5.0	-3.0	-5.0	-2.0	-3.3
. Access Road	-5.0	-5.0	-5.0	-5.0	-1.0	-0.8	-3.4	-3.3	-3.4	-3.3	-1.0	-0.9
2. Proposed & Planned Land Use												
. Site Area	-4.3	-5.0	-4.3	-5.0	-4.1	-4.7	-4.0	-4.7	-3.8	-4.3	-2.1	-2.5
. Site Vicinity	-3.1	-4.5	-3.1	-4.4	-3.0	-4.4	-3.4	-5.0	-3.4	-5.0	-1.8	-2.7
. Community & Regional Area	-2.3	-3.8	-2.3	-3.8	-1.6	-2.6	-3.0	-5.0	-3.0	-5.0	-1.6	-2.6
. Access Road	-4.3	-5.0	-4.3	-5.0	-0.5	-0.6	-4.3	-4.9	-4.3	-4.9	-0.5	-0.6
3. Land Use Stability												
. Site Area	-4.4	-5.0	-3.2	-3.6	-3.6	-4.1	-2.6	-3.0	-1.8	-2.1	-2.2	-2.5
. Site Vicinity	-4.8	-5.0	-4.8	-5.0	-3.5	-3.6	-1.8	-1.9	-1.3	-1.4	-3.5	-3.6
4. Provincial Policies & Plans												
. Site Vicinity	-	-	-	-	-	-	-3.0	-5.0	-2.0	-3.3	-	-
. Community & Regional Area	-	-	-	-	-	-	-4.0	-5.0	-3.0	-3.8	-	-

[1] Factor suitability levels adjusted by the Site Selection Consultant.

c) Rationale

FSLs were adjusted to be relative to lowest score among the siting options, and no occurrence values were assigned a "0" rather than "-1" value.

2.2.3 GLAL BIOLOGY

a) Review of Inputs

There are some interconnections among the biology factors that make it difficult to treat them as discrete units.

The data are scaled using judgements regarding the relative difference between options rather than numerical values. Both ordinal and interval scaling was used. For the purpose of the quantitative analysis, all data were assumed to be interval.

Zero is not applied to "no occurrence" of features at the subindicator level.

b) Changes

No change.

2.2.4 CLAYTON - ECONOMIC BASE

a) Review of Inputs

All data applied were interval and no specific limitations or assumptions were identified.

b) Changes

The economic consultant combined the economic factors used by the agriculture and tourism consultants to obtain an overall economic base conclusion.

The subfactors combined by the economic consultant were deleted from the analysis to avoid double-counting. One exception was made; the agriculture factors for displacement and partial displacement of farms were maintained in the agricultural analysis because displacement of farms can have important impacts on agriculture that are not strictly economic (e.g. impacts on farm operations, loss of network of farm operators).

c) Rationale

Clayton Research Associates Ltd. combined factors from several consultants' work into an economic base factor. The aggregated economic base factor was treated as a single factor in the quantitative analysis because the economic consultant combined the economic base, agriculture and tourism economic impacts (see Appendix E). The following factors were combined by the economic consultant:

Economic Base[1]

- displacement of business activity;
- property value impact;
- business activity positively affected by the presence of OWMC facilities;
- business activity negatively affected by the presence of OWMC facilities;
- community and regional economic base.

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[1] Economic consultant (Clayton, 1985a)

Agriculture[2]

- displacement of farms with on-site headquarters;
- partial displacement of farms with on-site land;
- disruption to the farm economy.

Tourism[3]

- tourism economy;
- tourism operations.

2.2.5 ORF - AIR QUALITY

a) Review of Inputs

For the impact factor "restraints to dispersion", ordinal data were used. These data were interpreted as interval data for the analysis.

b) Changes

The range of values for the FSLs is from a maximum of 0 to -5.0. The best option will have a value of 0. Table F.4 contains the changes made to the ORF factor suitability levels.

c) Rationale

FSLs were adjusted to range form 0 to -5.0 and scaled relative to the lowest score among the siting options.

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[2] Agriculture consultant (Ecologistics, 1985)
[3] Social consultant (IER, 1985e)

TABLE F.4

CHANGES MADE TO AIR QUALITY IMPACT

FACTOR SUITABILITY LEVELS

FACTORS	LF-3C		LF-9C		LF-1E		LF-1E/PI-27E		LF-4N/PI-1N		LF-4N/PI-13N	
	ORF	Adj.[1]	ORF	Adj.	ORF	Adj.	ORF	Adj.	ORF	Adj.	ORF	Adj.
Existing and Anticipated Air Quality	-2.1	-2.8	-2.2	-2.9	-2.6	-3.5	-3.7	-5.0	-2.4	-3.3	-2.5	-3.4
Restraints to Dispersion	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-5.0	-5.0	-5.0	-3.0

[1] Factor Suitability levels adjusted by the Site Selection Consultant.

2.2.6 MUNICIPAL FINANCE AND AGRICULTURE

a) Review of Inputs

All data were interval and no specific limitations or assumptions were identified.

b) Changes

No changes were made.

3.0 COMPARISON OF RESULTS TO RANKING BY INDIVIDUAL CONSULTANTS

Some minor change in the overall ranking of siting options by individual consultants resulted from the quantitative aggregation. These differences are a result of the adjustments made to the factor suitability levels and differences between the factor weights applied by the site selection consultant and individual consultants.

The siting option rankings that resulted from the quantitative analysis were the same as those of the transportation, hydrogeology and surface water consultants.

The ranking of siting options for the air pathway varied somewhat from that of the air quality consultant for two reasons. First, the FSLs were adjusted to begin at 0 (rather than -1.0) for no observed risk, and to be relative to the least preferred option (which was assigned a -5.0). This had the effect of giving greater weight to the options closest in FSL to the least preferred option. In addition, the M.M. Dillon factor weights gave greater importance to direct inhalation - acute events (4.0 versus 3.7) and less importance to direct inhalation - chronic emissions (4.5 versus 5.0).

The effect of these changes was to disaggregate the five-point scale of the air consultant into a six-point scale.

Air Quality Consultant	Quantitative Analysis
LF-3C (best)	LF-3C (best)
LF-9C and LF-1E	LF-9C
LF-1E/PI-27E	LF-1E/PI-27E
LF-4N/PI-1N	LF-1E
LF-4N/PI-13N (worst)	LF-4N/PI-1N
	LF-4N/PI-13N (worst)

The only difference between the two scales is that LF-1E is preferred over LF-1E/PI-27E by the air quality consultant and the order is reversed in the quantitative analysis.

The rankings for the economic, municipal finance, agriculture, biology and land use disciplines are the same for the quantitative analysis as the consultants' rankings.

The land use consultant applied qualitative judgements to the ranking produced by the LKA numerical analysis not reflected in the quantitative analysis results.

The biology consultant did not undertake a numerical analysis, but rather, the siting options were grouped into three levels of preference. The numerical analysis supports these groupings.

The rankings for the air quality impact factors indicate a difference between LF-3C and LF-9C not identified by the air quality consultant (LF-9C and LF-3C were ranked as equal by ORF). LF-3C is slightly preferred in the quantitative analysis based on existing air quality characteristics. This difference was identified by the air quality consultant, but was obscured by the numerical analysis used to develop factor suitability levels.

The quantitative analysis resulted in LF-9C being ranked as second most preferred and LF-1E/PI-27E being ranked as third for the social discipline. The social consultant ranked LF-9C and LF-1E/PI-27E third and second respectively. The numerical difference between these two options was, however the smallest between any two options. This inconsistency was caused by the scaling of the social consultant's factor scores and changes to the magnitude of the factor weights.

4.0 COMPARISON OF RESULTS OF QUANTITATIVE AGGREGATION WITH AND WITHOUT ADJUSTMENTS

As discussed in Chapter 7 (Section 7.2.1) a number of land use factors were deleted from the quantitative analysis to remove cases of double-counting.

The results of the quantitative aggregation for Procedures 1 and 2, with and without adjustments, are presented in Tables F.5 (Procedure 1 - without adjustments), F.6 (Procedure 1 - with adjustments), F.7 (without adjustments) and F.8 (with adjustments).[1]

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[1] Note that factor rankings used are proportional to those presented in Chapter 4 and range from 0 to 5.

TABLE F.5

Procedure 1 - Quantitative Analysis

Aggregate by Disciplines
(Divide Factor Score by Number of Factors)

	LF-3C	LF-1E	LF-9C	LF-1E/PI-27E	LF-4N/PI-1N	LF-4N/PI-13N
Risk Pathways (Subtotals)						
Transportation	-19.00	-10.50	-17.13	-10.50	-7.30	-6.93
Air	-8.69	-11.65	-8.84	-11.29	-12.60	-13.75
Surface Water	-8.13	-3.13	-6.10	-3.65	-6.63	-10.78
Hydrogeology	-4.25	-18.75	-11.25	-18.75	-21.25	-23.75
Impacts (Subtotals)						
Social	-11.12	-6.89	-8.82	-9.05	-9.74	-10.82
Economic	-12.40	-10.80	-4.00	-12.00	-14.00	-20.00
Municipal Finance	14.70	8.40	15.00	6.90	0.60	0.30
Agriculture	-17.34	-10.03	-13.81	-8.66	-13.79	-15.16
Natural Environment	-5.19	-5.69	-4.81	-8.56	-4.31	-4.94
Land Use	-7.74	-6.77	-7.36	-5.86	-8.73	-8.85
Air	-4.70	-5.75	-4.85	-8.00	-7.45	-6.60
Total Risk[1]	-70.11	-77.04	-75.80	-77.33	-83.61	-96.60
Total Impacts	-43.79	-37.53	-28.65	-45.23	-57.42	-66.07
Total	-113.90	-114.58	-104.45	-122.56	-141.03	-162.67

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[1] Risk values adjusted to remove effects of number of impact disciplines and risk pathways.

TABLE F.6

Procedure 1 - Quantitative Analysis (Adjusted for Factor Overlaps)

Aggregate by Disciplines
(Divide Factor Score by Number of Factors)

	LF-3C	LF-1E	LF-9C	LF-1E/ PI-27E	LF-4N/ LF-1N	LF-4N/ PI-13N	HYPOTHETICAL BEST SITING OPTION
Risk Pathways (Subtotals)							
Transportation	-19.00	-10.50	-17.13	-10.50	-7.30	-6.93	-5.30
Air	-8.69	-11.65	-8.84	-11.29	-12.60	-13.75	-5.40
Surface Water	-8.13	-3.13	-6.10	-3.65	-6.63	-10.78	-3.13
Hydrogeology	-4.25	-18.75	-11.25	-18.75	-21.25	-23.75	-4.25
Impacts (Subtotals)							
Social	-12.05	-7.47	-9.55	-9.81	-10.55	-11.73	-4.81
Economic	-12.40	-10.80	-4.00	-12.00	-14.00	-20.00	-4.00
Municipal Finance	14.70	8.40	15.00	6.90	0.60	0.30	15.00
Agriculture	-17.34	-10.03	-13.81	-8.66	-13.79	-15.16	-7.42
Natural Environment	-5.19	-5.69	-4.81	-8.56	-4.31	-4.94	-2.06
Land Use	-8.48	-6.38	-8.42	-4.10	-10.21	-9.59	-4.10
Air	-4.70	-5.75	-4.85	-8.00	-7.45	-6.60	-4.70
Total Risk[1]	-70.11	-77.04	-75.80	-77.33	-83.61	-96.60	-31.63
Total Impacts	-45.46	-37.71	-30.44	-44.23	-59.71	-67.72	-12.09
Total	-115.57	-114.76	-106.24	-121.55	-143.32	-164.32	-43.72

[1] Risk values adjusted to remove effects of number of impact disciplines and risk pathways.

TABLE F.7

Procedure 2 - Quantitative Analysis

Aggregate by Study Area
(Divide Factor Score by Number of Factors)

	LF-3C	LF-1E	LF-9C	LF-1E/PI-27E	LF-4N/PI-1N	LF-4N/PI-13N
Impacts (Subtotals)						
A. Site	-9.31	-11.51	-7.64	-11.51	-8.90	-9.51
B. Site Vicinity	-9.20	-7.37	-8.12	-9.23	-9.79	-10.95
C. Community and Regional	-10.12	-8.57	-8.39	-8.88	-11.15	-11.82
D. Access Roads	-11.20	-0.67	-8.19	-0.69	-6.69	-7.31
Total Impacts	-39.83	-28.11	-32.34	-30.31	-36.53	-39.59
Total Risk	-40.06	-44.03	-43.31	-44.19	-47.78	-55.20
Total	-79.89	-72.14	-75.65	-74.50	-84.31	-94.79

TABLE F.8

Procedure 2 - Quantitative Analysis (Adjusted for Factor Overlaps)

Aggregate by Study Area

(Divide Factor Score by Number of Factors)

	LF-3C	LF-1E	LF-9C	LF-1E/ PI-27E	LF-4N/ LF-1N	LF-4N/ PI-13N	HYPOTHETICAL BEST SITING OPTION
Impacts (Subtotals)							
A. Site	-10.61	-12.19	-9.01	-12.29	-9.90	-10.81	-5.09
B. Site Vicinity	-9.36	-7.03	-8.17	-9.14	-10.03	-10.94	-5.01
C. Community and Regional	-10.51	-9.14	-8.59	-9.13	-11.28	-12.02	-5.43
D. Access Roads	-11.35	-0.55	-7.97	-0.55	-6.70	-7.39	-0.30
Total Impacts	-41.84	-28.92	-33.73	-31.12	-37.90	-41.17	-15.83
Total Risk	-40.06	-44.03	-43.31	-44.19	-47.78	-55.20	-18.08
Total	-81.90	-72.95	-77.04	-75.31	-85.68	-96.37	-33.91

APPENDIX G
(APPENDIX TO CHAPTER 8)

OVERVIEW EVALUATION OF DIFFERENCES BETWEEN TOTAL AND PARTIAL SOLIDIFICATION

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1.0 OVERVIEW EVALUATION OF DIFFERENCES BETWEEN TOTAL AND PARTIAL SOLIDIFICATION

1.1 INTRODUCTION AND PURPOSE

The Phase 4A site selection process assumed total solidification[1] in which all waste residues and liquid effluents are solidified and deposited in the landfill. The engineering consultant, Monenco Limited undertook an analysis of partial solidification[2] as an alternative to total solidification as part of their Phase 4A analysis. The major difference between total and partial solidification is the requirement to dispose of an aqueous effluent with partial solidification. There are a number of options available for the disposal of this effluent.

Preliminary analysis of the partial solidification option by Monenco pointed to significant economic advantages using partial solidification over total solidification. It was also apparent that with the partial solidification option, there may be a reduction in the magnitude of some of the impacts associated with total solidification. Consistent with the Phase 4A site selection analysis, the Ontario Waste Management Corporation (OWMC) viewed the partial solidification option as a means of mitigating some of the impacts and costs associated with total solidification.

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[1] "Solidification is a process where wastes and residues from the treatment processes are mixed with chemical reagents such as cement and sodium silicate to form stable solids" (Monenco, 1985, p.55).

Total solidification refers to an operating mode "in which all effluent from the physical/chemical treatment plant is solidified and sent to landfill" (Monenco, 1986, p.128).

[2] Partial solidification is a process whereby waste residues and effluents are subjected to treatment such that the volume of treated materials is reduced, but a liquid effluent is produced, requiring alternative disposal.

The purpose of this study is:

- to identify appropriate disposal options;
- to determine if there were any major constraints associated with any siting options that might preclude an effluent disposal option;
- on the basis of major constraints to rank disposal options on a siting option basis;
- to provide input to the site selection process for the consideration of partial solidification.

This appendix documents the major differences between total and partial solidification. It provides the assumptions used in the analyses of effluent disposal options and indicates which options were considered. The analysis and results of the evaluation of effluent disposal options are presented first on a generic basis and then on a site-specific basis. The site-specific analysis identifies any major constraints that might preclude an effluent disposal option for any siting option.

1.2 SCOPE AND LEVEL OF DETAIL

M.M. Dillon Limited was responsible for coordinating and synthesizing the technical inputs from the other site selection consultants. The other site selection consultants involved in this study and their area of responsibility are:

- Gartner Lee Associates Limited/Gore and Storrie Limited - surface water analysis;
- Gartner Lee Associates Limited - biology;

- Institute of Environmental Research Inc. - socio-economic analysis;
- Leon Kentridge Associates Limited - land use analysis;
- Ontario Research Foundation - air dispersion analysis;
- M.M. Dillon Limited - transportation analysis;
- Monenco Limited - engineering.

In addition, OWMC provided overall direction to the analysis and technical input in the area of approvals.

The analysis was not undertaken at the same level of detail as the mainstream Phase 4A analysis. The analysis employed 1:50,000 scale base mapping with limited field verification. There was no agency or public input or review. However, the analysis undertaken was adequate for the study purposes.

The results of the study are not intended as the sole basis for a decision on the choice of total or partial solidification or the choice of a particular disposal option. Additional study should be undertaken before final decisions regarding such choices are made.

1.3 ASSUMPTIONS

A number of assumptions were provided by OWMC. These assumptions were:

- the effluent quantity under consideration was the worst case annual amount requiring disposal based on year 20 of the facility operation and the maximum incoming facility waste quantity of 300 000 tonnes per annum (t/a). The quantity provided was 172 500 t/a;

- the effluent stream is composed of:

  i) physical/chemical treatment process effluent including treated contaminated/potentially contaminated surface drainage and treated landfill leachate; and

ii) sewage effluent;

- the quality of the effluent leaving the facility will vary depending upon the discharge point and disposal option. As a minimum, it will meet the Ministry of the Environment Objective for Control of Industrial Waste Discharge in Ontario with respect to discharge to a lake and discharge to a sewage treatment plant and Regulation 308 under the Environmental Protection Act with respect to air discharge.

1.4 DIFFERENCES BETWEEN TOTAL AND PARTIAL SOLIDIFICATION

The engineering consultant, Monenco Limited developed a set of facilities characteristics assumptions for partial solidification (Monenco, 1986). Any changes or additions to facilities characteristics assumptions as a result of the adoption of partial solidification are also noted in Appendix A of Volume 1 of this report.

The major differences between partial and total solidification are summarized as follows:

- requirement to dispose of an aqueous effluent;

- increased landfill life as a result of the reduction in the solidified material deposited in the landfill; or reduction in landfill area requirements; or reduction in material delivery to the landfill for cell development; or lower cost of landfill cell development;

- reduction in the amount of additives and reagents required at all candidate sites;

- reduction in the number of intersite truck movements. The adoption of partial solidification results in a 6.4% to 24.2% reduction in the total number of transport vehicles movements required (M.M. Dillon, 1985b, p.258);

- reduction in transportation risks and impacts as a result of fewer truck movements;

- reduced cost of materials;

All of the differences, with the exception of effluent disposal, produce impacts and costs lower in magnitude with partial solidification than with total solidification. The requirement to dispose of an aqueous effluent with partial solidification is the only difference which produces impacts which may be of greater magnitude or which may occur outside previously established study areas.

1.5 OPTIONS UNDER CONSIDERATION

A number of technologies are available for the discharge of effluent from the OWMC facility. These technologies can be grouped into two categories: on-site and off-site discharges. The on-site discharge options include solidification, evaporation[1] and deep well disposal. The off-site discharge technologies include pipeline, truck haul and rail haul. These effluent disposal technologies are described in Table G.1.

All the technologies identified have been used for disposal of effluent by industry. However, deep well disposal has not been used to a great extent in Southern Ontario. The feasibility of deep well disposal of treated effluent was examined in a study undertaken on behalf of OWMC (GLAL, 1985). This report indicates a number of uncertainties with the subsurface conditions expected in the area of the facility. Other concerns relate to the volume of effluent to be disposed of, the approval process and public perceptions of this technology. As a result, deep well injection was not considered as an effluent disposal option for the purposes of this study.

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[1] Evaporation refers to an effluent disposal option "where the treated effluent is evaporated and discharged to atmosphere while residues are solidified prior to disposal in the engineered landfill" (Monenco, 1986, p.113).

Rail haul was also not considered an effluent disposal option in Phase 4A. Rail service (see Chapter 6, Volume 1) has been identified as an opportunity which may or may not be provided to candidate sites at some point in the future. It also appeared unlikely that direct rail connections using existing lines could be made between the candidate sites and discharge locations. Furthermore, an analysis of rail haul cost by M.M. Dillon Limited concluded that rail haul costs are at least equal to, if not greater than, road haul costs. In view of the uncertainties regarding whether rail services can be provided between the candidate sites and the disposal location, it was concluded that rail haul should not be considered further.

Therefore, evaporation, pipeline and truck haulage are the effluent disposal options examined in this study. A number of assumptions and concepts specific to each of these disposal options are listed Table G.2.

1.6 EVALUATION OF EFFLUENT DISPOSAL OPTIONS

1.6.1 INTRODUCTION

The evaluation of effluent disposal options occurred in two steps:

- Step 1 - a generic evaluation and ranking of effluent disposal options;
- Step 2 - a site-specific evaluation and ranking of effluent disposal options.

TABLE G.1

Available Effluent Disposal Technologies

Disposal Category	Disposal Type	Disposal Description
On-Site	Solidification	This technology provides for solidification of the liquid effluent and placement of the solidified material in the engineered landfill. Referred to as total solidification, it is not being considered in this study as it is the base case for the site selection analysis (Monenco, 1986).
On-Site	Evaporation	With this option the liquid effluent is evaporated using supplementary fuel and is discharged through a stack on-site, to disperse in the atmosphere over the site (Monenco, 1986).
On-Site	Deep Well Disposal	With this option the liquid effluent is injected through a well into a deep geologic formation (i.e. Cambrian formation) that has the capacity to receive liquids.
Off-Site	Pipeline	With this option the liquid effluent is treated on-site, piped under pressure from the facility to either Lake Ontario or Lake Erie or discharged to a Municipal sewer system/suitable sewage treatment plant for treatment prior to discharge.
Off-Site	Truck Haul	With this option the liquid effluent would be loaded on tanker trucks at the facility and transported by road to a municipal sewage treatment plant where it would be treated prior to release into the receiving body.
Off-Site	Rail Haul	With this option the liquid effluent is loaded on rail cars at the facility and is transported by rail to a municipal sewage treatment plant where it would be treated prior to release into the receiving body.

TABLE G.2

Effluent Disposal Assumptions and Concepts

PIPELINE OPTION	TRUCK OPTION	EVAPORATION OPTION
Assumptions o pipeline will be built within road right-of-ways wherever possible o maximum (worst case) effluent quantity = 172 500 t/a o based on 250 days/a and 8 h/day design flow = 90 m^3/h o pipeline sizing is optimized in terms of capital and operating cost, and is 150 mm for all siting options o discharge locations are Lake Ontario or Lake Erie or to a municipal sewer if the municipality has indicated a willingness to accept the effluent **Concept** The treated effluent from the physical/chemical plant will be directed to effluent holding ponds. Two pump wells with two 55% pumps each will take suction from the effluent ponds. The discharge from each pump will be to a header which will be connected to the U/G, 150 mm pipeline to the lake. The pipeline will extend 5 km or a minimum depth of 15 m from shore into either Lake Erie or Lake Ontario culminating in an outfall for dispersion of effluent. Two pumps will be working 8 h/d for 250 d/a and two pumps will provide 110% standby capacity.	**Assumptions** o truck routes from the facility to a discharge point are selected to minimize transit time, maximize the use of 400 series highways and minimize exposure to populated areas o the truck sizing and the development of truck requirements and costing is consistent with that employed in the base case analysis o the discharge point for all trucking options is a municipal sewage treatment plant o maximum effluent quantity is 172 500 t/a o trucks will operate 250 days/year for 8 hours/day o 23 trucks per day o closest suitable sewage treatment plant to a candidate site with a physical/chemical treatment plant facility **Concept** Loading of trucks at the OWMC facility will be by pumps taking suction from the effluent holding ponds. Four pumps (two each in two pump wells) are provided and specified such that each of the pumps can fill a 30 t tanker truck in 15 minutes, at a loading station. At the sewage treatment plant, the trucks will be unloaded by two pumps (each capable of unloading a 30 t tanker truck in 15 minutes) on to an above ground holding pond to provide surge capacity of one day's deliveries. This holding pond also allows flexibility at the STP to feed this effluent at rates compatible with sewage flow rates From the holding pond, the effluent will be fed at a controlled rate, by gravity, to the sewage main at the lift station of the STP	**Assumptions** o the maximum (worst case) quantity of effluent to be evaporated is 172 500 t/a o evaporator will work on a continuous basis and hence operate 8000 hours/year with 90% availability. Buffer storage capacity to accommodate the imbalance between 250 days/year operation of the physical/chemical plant and continuous operation of evaporators, is provided by treated effluent holding ponds o two evaporators with 70% of maximum duty each have been considered to provide adequate standby capacity and flexibility o the facilities steam balance for Case 1 (integrated) and Case 2 (separate landfill) indicate that less than 25% of steam required for evaporation is available as excess steam from incinerator plant in the summer and no excess steam in the winter **Concept** In all siting options, the evaporators are located at the physical/chemical plant site. The evaporators are single effect, forced circulation type. Up to 100 times the concentration of TDS in the effluent feed can be achieved in the evaporator such that only a small bleed (1%) of concentrated liquor will be sent to solidification and 99% of effluent feed is discharged to atmosphere as steam. The treated effluent from the holding ponds is fed to the evaporators by pumps. The steam would be released through a stack and would then mix vigorously with ambient air and undergo rapid cooling. In so doing, condensation would occur, giving rise to a visible plume of water droplets. As further mixing occurs with ambient air, the plume would become deeper and wider but water droplets would gradually re-evaporate. The rate of this re-evaporation would depend on the ambient temperature and humidity conditions (the rate would be higher in warm weather and

TABLE G.2

Effluent Disposal Assumptions and Concepts

PIPELINE OPTION	TRUCK OPTION	EVAPORATION OPTION
		Concepts - Continued humidity conditions) and the degree of turbulent mixing with the environment, which is itself a function of wind speed and atmospheric stability (the re-evaporation rate would be enhanced by higher wind speeds and atmospheric instability). In the condensed phase, the droplets would be visible as an elevated white plume extending from a point a short distance from the top of the stack downwind until, due to re-evaporation, it gradually disappears. Apart from the potential problem of aesthetics, the condensed region of the plume may become deep enough under some conditions to impinge on other plant structures and on the ground at some distance from the point of release. This may result in impaired visibility and, in cold weather, icing of roads and structures. Under some conditions water droplets may coalesce and fall out of the plume, resulting in icing conditions underneath the plume. A further concern relates to contaminants which may be present in the feed water and be released to the atmosphere with the steam. These would be dispersed with the plume and, thus, may become potential pollutants in ambient air at ground level downwind from the stack. The contaminants may also be deposited to ground underneath the plume, having been 'rained out' with the coalesced water droplets.

The purpose of Step 1 was twofold:

i) to review the disposal options to determine if there are any significant constraints which would preclude the use of a particular option. This evaluation was based on a review of potential uses and impacts, costs, approvals and technology;

ii) to rank the effluent disposal options with respect to risks and impacts, costs, approvals and technology.

The purpose of Step 2 was:

i) to determine if a suitable disposal option existed for each of the siting options;

ii) to derive an overall ranking of disposal options on a siting option basis.

1.6.2 STEP 1

The Step 1 evaluation was based on a review of potential risks and impacts, costs, approvals and technology.

(a) Evaluation of Risks and Impacts

Introduction

Table G.3 documents the major risks and impacts associated with the truck haul, pipeline and evaporation options. The significance of identified risks or impacts were assessed based on potential constraint posed to disposal option development.

TABLE G.3

Potential Risks and Impacts - Effluent Disposal Options

EFFLUENT DISPOSAL OPTION	POTENTIAL RISKS AND IMPACTS	COMMENTS
o Truck Haul	o impacts associated with increased truck traffic on access routes. Includes the potential disturbance to the use and enjoyment of property and public and private facilities as a result of truck noise and potential interference with property access and local traffic movements	o potentially significant concern o differs by access route, more appropriately considered on a siting option basis
	o effluent to be treated as a minimum to Ministry of the Environment (MOE) Objectives for Control of Industrial Waste Discharge in Ontario prior to release; therefore, low potential for risk to human health in the remote event of an accidental release	o not significant
	o potential for perceived risks and impacts by the residents and users of the receiving body at the point of discharge	o needs to be considered, difficult to quantify o differs by discharge location, more appropriately considered on a siting option basis
	o requires a sewage treatment plant with ability to handle OWMC effluent and discharge to a suitable receiving body	o potentially significant constraint, if no suitable sewage treatment plant and/or a suitable receiving body available
o Pipeline	o effluent to be treated as a minimum to Ministry of Environment (MOE) Objectives for Control of Industrial Waste Discharges in Ontario prior to release; therefore low potential for risk to human health in the remote event of an accidental release;	o not significant
	o potential for perceived risks and impacts by the residents and users of the receiving body at the point of discharge	o needs to be considered, difficult to quantify o differs by discharge location, more appropriately considered on a siting option basis
	o potential impacts associated with construction	o not significant; construction would not be a complex or major effort o impacts are temporary and can be mitigated
o Evaporation	o potential for concentration of contaminants at ground level due to contaminants in the effluent stream	o potentially significant constraint o extent needs to be determined
	o potential visual impact of the steam plume which would emanate from the evaporator	o potentially significant constraint o extent needs to be determined
	o potential for fogging and icing on plant structures and at ground level	o potentially significant constraint o extent needs to be determined

Trucking

The availability of a sewage treatment plant which can handle OWMC's effluent is a potential constraint to the development of the disposal option. Other water uses and dispersion characteristics in the vicinity of the outfalls of the sewage treatment plants also represent potential constraints.

A number of sewage treatment plants were initially identified as feasible receivers and discharge points for OWMC facility effluent (Kilborn Limited, 1983). This list was refined based on reviews by Gartner Lee Associates Ltd. and Gore and Storrie Ltd. The Gartner Lee and Gore & Storrie review used previously collected data to obtain a sense of the opportunities for the safe discharge of treated water from the OWMC facility. Suitable sewage treatment plants, in proximity to the candidate sites, were identified.

On the basis of the above, the disposal concept of trucking effluent to a sewage treatment plant from an OWMC facility is feasible. Possible impacts associated with increased truck traffic on access routes and the risks and impacts perceived by the residents and users of the receiving body at the point of discharge need, however, to be further evaluated on a siting option basis. Further evaluation of the suitability of sewage treatment plants to receive OWMC effluent also needs to be undertaken.

Pipeline

The impacts associated with discharge of the treated effluent to a receiving body are potentially significant. Suitable receiving bodies have, therefore, been identified.

Various locations along the shoreline of western Lake Ontario and eastern Lake Erie were reviewed because of their proximity to the candidate sites. The purpose of this review was to determine the opportunity for the safe discharge of treated effluent from the OWMC Facility. This review was undertaken by Gartner Lee Associates Limited and Gore and Storrie Limited. It relied solely on existing information and on surface water work completed in Phase 3A.

The review concluded that offshore discharges at a distance of at least 5 km from shore or at a minimum depth of 15 m are feasible. It also recognized that in some locations more detailed investigations may show that discharges within 5 km from shore and/or at less than 15 m deep may also prove feasible (GLAL and Gore and Storrie Limited, 1984).

Evaporation

The potential for exceeding Ontario's air quality standards and guidelines was assessed by calculating the ground level point of impingement concentration of each contaminant in the ambient air. The plume dispersion model found in Regulation 308 under the Environmental Protection Act was used.

The analysis shows that, for all identified contaminants and stack heights, the calculated point of impingement concentrations are generally well within the applicable air quality standard or guideline. The only exception is chloride, which exceeds the HCl standard when a 25 m stack is used and the amount present in the feedwater is at the level allowable for discharge to a treatment plant. This occurs assuming that all chloride is present as HCl. In view of the conservative assumptions embodied in the estimated emission rate, this exceedence is unlikely to occur in practice.

Although deposition by rainout has been identified as another potential route of contaminants to the ground, there are no applicable air quality standards and guidelines to be met in this case, with the possible exception of fluoride in forage crops. No analysis has been undertaken since impacts due to deposition are considered unlikely.

The potential for fogging and icing at ground level was also assessed. This analysis showed that fogging would occur only with extreme unstable atmospheres and extremely cold temperatures. This combination is unlikely to occur in practice (the most unstable conditions normally occur in summer) and any impaired visibility under these conditions would be limited to OWMC property and would be highly intermittent. It was also noted that there was potential for mitigating these impacts (i.e. not evaporating under adverse conditions.) It was, therefore, concluded that there would be no significant potential for ground level fogging and icing.

The preliminary assessment indicates that the stack plume from the evaporator would not result in any significant impacts on local air quality or in significant fogging or icing effects. However, a visible plume of condensate would be formed under almost all conditions. Typically, this would be several hundreds of metres long and, under extreme conditions, could be 7 km or more in length.

(b) Evaluation of Cost

Present worth of lifecycle annual costs was calculated for each of the disposal options. The economic ratios were consistent with those used in the site selection process (Monenco, 1986).

The present worth of lifecycle annual costs for each option is listed in Table G.4.

TABLE G.4

Capital and Operating Costs - Disposal Options

Disposal Option	Truck Haul	Pipeline	Evaporation
Present Worth of Lifecycle Annual Costs (Average of present worth of lifestyle annual costs ($'000))	$8,366	$6,049	$28,581

(c) **Evaluation of Approvals**

The effluent disposal options were evaluated in terms of degree of difficulty likely to be encountered in advancing them to and through the hearings and approval process (OWMC, 1985). This evaluation was undertaken by OWMC staff and provided to Dillon.

The evaluation was based on the following criteria:

- Ease of Approval - the highest score goes to the option perceived to have the greatest ease of approval;

- Ease of Workplan - considers the overall additional scope of work, cost and time which would be involved for each of the options; the highest score goes to the option requiring the least additional work;

- New Municipal Jurisdictions Involved - refers to the likelihood that the consideration of a particular option will necessitate involvement of new municipal jurisdictions; the fewer the new jurisdictions, the higher the score;

- New Approvals Required - considers the additional approvals which would be necessitated by each option; the fewer the new approvals, the higher the score.

- New Public Consultation - the extent to which each of the options would require the involvement of new segments of the public considered; the fewer new public consultation requirements, the higher the score.

The ranking of the disposal options from an approvals perspective are listed in Table G.5.

(d) Evaluation of Technology

The technologies to be employed were evaluated based on criteria established by OWMC and Monenco Limited (Monenco Limited, 1985).

The evaluation factors included:

- performance;
- flexibility;
- reliability;
- safety;
- operability;
- economics and commercial;
- Canadian and Ontario benefits.

The evaluation of the disposal options on the basis of technology is summarized in Table G.6.

(e) Evaluation and Ranking of Disposal Options

Table G.7 summarizes the results of the comparative evaluation of the three disposal options.

The disposal options were ranked, from most suitable to least suitable in terms of risks, impacts, cost, approvals, and technology. The disposal options were ranked (from most to least suitable) as follows:

- evaporation;
- pipeline;
- trucking.

Table G.8 provides the rankings and rationale for the ranking of effluent disposal options.

TABLE G.5

Approvals Evaluation - Effluent Disposal Options

Evaluation Factor	Evaporation	Total Solidification	Trucks To STP	Trucks To Outfall	Pipeline To STP	Pipeline To Outfall
Ease of Approval	6	5	4	3	2	1
Ease of Work Plan	6	5	4	3	2	1
New Municipal Jurisdiction	6	5	4	3	2	1
New Approvals	5	6	4	3	2	1
New Public Consultation	5	6	4	3	2	1

Scoring 6 = "best"
1 = "worst"

Source: OWMC, 1985

TABLE G.6

Technology Evaluation Effluent Disposal Options

	Technical Evaluator Factors					
Disposal Option	Performance Max: 20	Flexibility Max: 20	Reliability Max: 15	Safety Max: 20	Operability Max: 10	Canada/Ontario Benefits Max: 5
Pipeline	20	20	15	20	10	5
Trucking	20	20	12	15	5	5
Evaporation	17	20	15	20	10	5
Solidification	15	20	15	20	10	5

Source: Monenco Limited, 1985b

TABLE G.7

Evaluation of Effluent Disposal Options

SITING OPTION	PIPELINE	TRUCKING	EVAPORATION
Risks and Impacts	o temporary short-term impacts during construction o impacts are generally confined to a small area o pipeline right-of-way to be located within existing road right-of-way wherever possible (and feasible) o construction impacts easily mitigated with standard practices and procedures o no operating impacts (under normal operating conditions) o perceived impact and/or risk at the discharge location (greater at sole OWMC discharge than STP)	o operating impacts - increased noise, dust, etc. along routes o increased risk of accident to the other users of the routes o perceived impact and/or risk at the discharge location (Sewage Treatment Plant) (less than at sole OWMC discharge)	o preliminary analysis indicates that: - effluent quality will not be of concern - if a slightly higher stack is used (37 or 38 m vs. 25 m) the steam will remain within the site boundaries - there is potential for fogging and icing off-site depending upon weather conditions - the plume will be highly visible
Technology	o most suitable	o least suitable	o moderately suitable
Approvals Ranking: 6 - best 1 - worst	o to outfall: 1 o to STP: 2	o to outfall: 3 o to STP: 4	6
	o present worth of Lifecycle Annual Costs ($'000)[1] 6049	8366	28,581

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[1] Average of the percent worth of lifecycle annual costs by siting option

TABLE G.8

Ranking of Disposal Options

RANKING	DISPOSAL OPTION	REASONS FOR RANKING
Most Suitable	Evaporation	o high costs, but negligible off-site impacts o visual impacts may be a concern, but requires further analysis o most suitable approvals o moderately suitable technology
	Pipeline	o impacts short-term, mitigable o perceived risks and impacts at outfall o low costs, but moderate capital costs o most suitable technology o worst approvals
Least Suitable	Trucking	o impacts potentially major along access routes o perceived impacts and risks at outfall; slightly less at sewage treatment plant than at sole OWMC discharge o moderate costs o moderate approvals o least suitable technology

1.6.3 STEP 2 - EVALUATION OF SITE-SPECIFIC DISPOSAL OPTIONS

1.6.3.1 Introduction

In this section the three disposal options are evaluated on a siting option basis. The basis for the development of each option is highlighted in Table G.9.

TABLE G.9

Basis for the Development of Disposal Options on a Siting Option Basis

DISPOSAL OPTION	METHOD	BASIS
Truck	Access road routes	o selection of truck routes from the facility to a discharge location based on: - minimizing the time in transit - maximizing the use of 400-series highways - minimizing exposure to populated areas o routes were not optimized
Pipeline	Route adjacent to roads	o pipeline to be built within road right-of-ways wherever possible o shortest route along road right-of-ways between facility and discharge point o routes were not optimized
Evaporation	On-site	o impacts off-site considered to be negligible o acknowledge visual impact needs further, more detailed study

Pipeline and truck routes were developed for the following siting options:

- LF-3C;
- LF-9C;
- LF-1E;
- LF-4N/PI-13N;
- LF-4N/PI-1N;
- LF-1E/PI-27E.

Figures 1 to 6 (at the back of this Appendix) depict the pipeline and truck routes identified.

1.6.3.2 Identification of Factors

The factors used by the site selection consultants to compare the effluent disposal options are listed in Table G.10. Factors were identified based on:

- the OWMC site selection goals and objectives:
- the scope and level of detail of the study;
- the characteristics of the effluent disposal options.

1.6.3.3 Ranking of Factors

(a) Introduction

It was determined that the factors employed in the comparative evaluation of disposal options were not equal in importance. The factors were therefore ranked. The ranking of factors occurred in two steps. Initially the factors were ranked on a disposal option basis. This initial ranking, when combined with the magnitude of impacts expected, provided the basis for the overall ranking of factors.

TABLE G.10

Factors Used in Comparative Evaluation

FACTOR GROUPING	FACTORS BY EFFLUENT DISPOSAL OPTION	
	TRUCKING	PIPELINE
Land Use	o % of land use designation within 2 km radius of discharge o kms of land use designation along route	o % of land use designation within 2 km radius o kms of land use designation along routes
Socio-Economic	o number of community and recreation features along route o number and size of population concentrations along route	o number of community and recreation features along route o number and size of population concentrations along route o community character at outfall
Biology	o number of stream crossings along route	o number of stream crossings along route
Transportation	o annual accident frequency	
Costs	o present worth of lifecycle annual costs	o present worth of lifecycle annual costs

(b) Ranking of Factors - By Effluent Disposal Option

The major reasons for the ranking of factors for the truck haul and pipeline disposal options, as developed by Dillon Site Selection, are provided in Table G.11.

A preliminary assessment of the evaporation option by the Ontario Research Foundation indicates that off-site impacts are unlikely, except for potential visual impacts due to the plume. As a result, no impact or risk factors were developed.

The cost factor for the evaporation option (present worth of lifestyle annual costs) was assigned a low constraint ranking.

(c) Ranking of Factors - Overall

The overall ranking of factors was based on the factor ranking by disposal option and on the expected magnitude of impacts associated with each disposal option.

Table G.12 provides the overall ranking of factors and the rationale for the ranking.

1.6.3.4 Application of Factors - Comparative Evaluation of Effluent Disposal Options

Table G.13 provides a summary of the data collected by the site selection consultants for each effluent disposal option, on a siting option basis. Site-specific truck haulage and pipeline disposal options were determined to be feasible for all siting options. No significant constraints to the development of any of the disposal options for any of the siting options were identified.

TABLE G.11

Ranking of Factors - By Effluent Disposal Option

EFFLUENT DISPOSAL OPTION	RANKING	FACTORS	RATIONALE FOR RANKING
o Truck Haul	High Constraint	o number and size of population concentrations along route o kms of land use designation along route o number of community and recreation features along route	o major concern is the potential for day-to-day disturbance along the access routes o potential disturbance includes truck noise and potential interference with property access and local traffic o use of property and private facilities could potentially be disturbed o routes which minimize distance through residential areas and past large numbers of recreation and community features preferred
	Moderate Constraint	o annual accident frequency o % land use designation within 2 km radius of discharge	o human exposure as a result of an accidental release considered somewhat less important as the effluent is to be treated to MOE objectives o it is assumed that the impacts upon water quality and aquatic life will be minor at a STP outfall, as the effluent will be treated o recognized that the residents of a community at the discharge location may perceive a risk or impact as a result of discharge, the difficulty in quantifying the perceived risk or impact or its magnitude resulted in the consideration of these factors to be somewhat less important than calculated risks or impacts
	Low Constraint	o number of stream crossings along route o present worth of lifecycle annual costs	o assuming that effluent has been treated to MOE objectives, concern associated with the accidental release of effluents into a stream course was considered to be of low significance o also recognized that the likelihood of a release into a major watercourse is even more remote o the cost factor was generally ranked lower than the other factors, reflecting OWMC's goals ranking of the site selection. However, it was recognized that, where a minimal reduction in risk or impact would have a substantial financial implication to OWMC, the cost factor would not necessarily be ranked lower than risk or impact (M.M. Dillon Limited, 1984)
o Pipeline	Moderate Constraint	o community character at outfall o % land use designation within 2 km radius of discharge	o at the outfall, it is assumed that the impacts upon water quality and aquatic life are minimal and that the outfall will be located at least 5 km from shore or at a depth of greater than 5 m o it is recognized that the residents or community at the discharge location may perceive a risk or impact as a result of discharge
	Low Constraint	o kms of land use designations along route o number of community and recreation features along route o number and size of population concentrations along route o number of stream crossings along route o present worth of lifecycle annual costs	o most serious impacts associated with pipeline construction, rather than operations; construction impacts generally short-term and largely mitigable o impacts expected to be minor since pipeline located within road right-of-ways o the cost factor was generally ranked lower than the other factors reflecting OWMC's ranking of the site selection goals. It was recognized that in instances were a minimal reduction in risk or impact would have substantial financial implications to OWMC, the cost factor would not necessarily be ranked lower than the impact or risk factors (M.M. Dillon Limited, 1984)

TABLE G.12

Overall Ranking of Factors

FACTOR RANK	EFFLUENT DISPOSAL OPTION	FACTOR	RATIONALE FOR RANKING
High	Truck Haul	o number and size of population concentrations along truck route	o major potential impact o potentially large number of people
	Truck Haul	o kms of land use designation along truck route	o major potential impact o potentially large number of people
	Truck Haul	o number of community and recreation features along truck route	o major potential o potentially large number of people
Moderate	Truck Haul	o % of land use designations within 2 km radius of discharge	o perceived impact o difficult to determine
	Pipeline	o community character at outfall	o perceived impact o difficult to determine magnitude of impact
	Pipeline	o % of land use designation within 2 km radius of discharge	o perceived impact o difficult to determine magnitude of impact
	Truck Haul	o annual accident frequency	o somewhat less important o effluent treated
Low	Truck Haul	o number of stream crossings along route	o relatively minor constraint
	Pipeline	o kms of land use designations along route	o relatively minor constraint
	Pipeline	o number of community and recreational features along route	o relatively minor constraint
	Pipeline	o number and size of population concentrations along route	o relatively minor constraint
	Pipeline	o number of stream crossings along route	o relatively minor constraint
	Truck Haul	o present worth of lifecycle annual costs	o cost is lowest ranked site selection goal
	Pipeline	o present worth of lifecycle annual costs	o cost is lowest ranked site selection goal
	Evaporation	o present worth of lifecycle annual costs	o cost is lowest ranked site selection goal

TABLE G.13

Summary of Impacts and Costs of Disposal Options By Siting Option[1]

SITING OPTION	EFFLUENT DISPOSAL OPTION	PIPELINE	TRUCKING	EVAPORATION
LF-3C	Impacts	o outfall located in cottage area with public beaches, conservation area and park o discharge to Lake Erie	o discharge to Baker Road STP - Grimsby o passes numerous community and recreation features o route passes through Vineland and terminates in Grimsby o majority of route in rural area (not including 400-series highway) o high annual accident frequency o STP discharge feasible, subject to further study	o site-specific evaluation not undertaken
	Costs ($'000)	6120	9716	28,581
LF-9C	Impacts	o outfall located in cottage area with public beaches, conservation area and park o discharge to Lake Erie	o discharge to Baker Road STP - Grimsby o passes numerous community and recreation features o route passes through Vineland and terminates in Grimsby o majority of route in rural areas (not including 400-series highway) o high annual accident frequency o STP discharge feasible, subject to further study	o site-specific evaluation not undertaken
	Costs $('000)	6431	8644	28,581
LF-1E	Impacts	o Alternative A - small single family residential community east of outfall - vineyards abundant in area - discharge to Lake Ontario o Alternative B - outfall located in cottage area, with private beaches - discharge to Lake Erie - small community at the end of Brookfield Road	o discharge to Port Dalhousie STP o passes moderate number of recreation and community features o route passes through and terminates in St. Catharines o a large portion of the route is in an urban area (St. Catharines) (not including 400-series highway) o moderate annual accident frequency o STP discharge feasible subject to further study	o site-specific evaluation not undertaken
	Costs ($'000)	5602	8351	28,581

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[1] Technology does not vary significantly by siting option. Approvals were not considered on a siting option basis.

TABLE G.13

Summary of Impacts and Costs of Disposal Options By Siting Option[1]

SITING OPTION	EFFLUENT DISPOSAL OPTION	PIPELINE	TRUCKING	EVAPORATION
LF-4N/PI-13N	Impacts	o single family residential east of outfall o Memorial Park/Beach and Marina on west side o 3 large apartments in vicinity o discharge to Lake Ontario	o discharge to southwest Oakville STP o passes through high number of recreation and community features o route passes through and terminates in Oakville (Bronte) o ½ of the route passes through residential areas o moderately low annual accident frequency o STP discharge feasible, subject to further study	o site-specific evaluation not undertaken
	Costs ($'000)	6491	8047	28,581
LF-4N/PI-1N	Impacts	o single family residential east of outfall o Memorial Park/Beach and Marina at outfall o 3 large apartments in vicinity o discharge to Lake Ontario	o passes high number of recreation and community features o route passes through and terminates in Oakville (Bronte) o ½ of the route passes through residential areas o low annual accident frequency o STP discharge feasible subject to further study	o site-specific evaluation not undertaken
	Costs ($'000)	5386	7415	28,581
LF-1E/PI-27E	Impacts	o Alternative A - small single family residential community east of outfall - vineyards abundant in area - discharge to Lake Ontario o Alternative B - outfall located in cottage area, with private beaches - small community at the end of Brookfield - discharge to Lake Erie	o discharge to Port Dalhousie STP o passes moderate number of recreation and community features o route passes through and terminates in St. Catharines o a large portion of the route is in an urban area (St. Catharines) (not including 400-series highway) o moderate annual accident frequency o STP discharge feasible subject to further study	o site-specific evaluation not undertaken
	Costs ($'000)	6288	8025	28,581

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[1] Technology does not vary significantly by siting option. Approvals were not considered on a siting option basis.

Table G.14 provides the rankings and a rationale for the rankings of the effluent disposal options, on a siting option basis.

1.7 CONCLUSIONS AND RECOMMENDATIONS

It was concluded that the ranking of effluent disposal options on a site-specific basis was the same as the ranking on a generic basis. The disposal options were ranked from most preferred to least preferred as follows: evaporation, pipeline and trucking. The study concluded that evaporation was the most preferred disposal option but all options should be evaluated at the preferred site. However, further action is recommended before a final decision regarding partial solidification should be made.

Subsequent to the completion of the M.M. Dillon Limited study, OWMC indicated a preference for the evaporation effluent disposal option. In view of this preference, a sensitivity analysis was undertaken which tested the ranking of siting options to the adoption of the evaporation disposal option (see Chapter 8).

It is recommended that the following additional analyses be undertaken before a final decision regarding partial solidification is made:

- the perceived risks and impacts associated with a pipeline discharge and with the trucking option should be examined in greater detail;
- the site-specific implications of partial solidification should be addressed for the preferred siting option;
- the site-specific analysis of partial solidification should be brought to a level of detail comparable to the Phase 4A base case evaluation;
- the extent and frequency of fogging and icing should be evaluated in detail to determine potential adjacent and site vicinity impacts;

- the length and frequency of occurrence of the steam plume should be determined;

- the implications of both the evaporator stack and the plume from a visual perspective should be addressed;

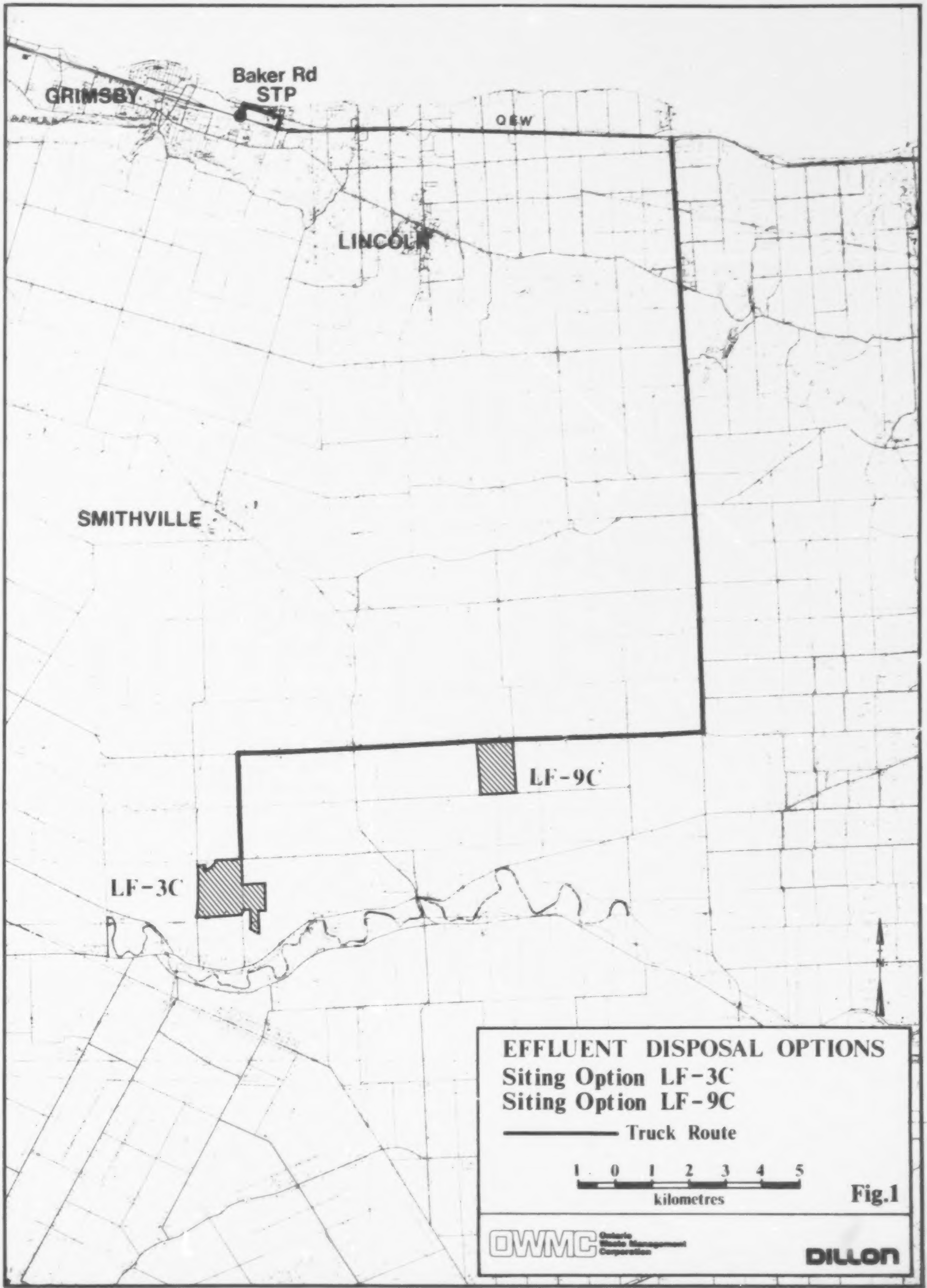
- the nature and significance of evaporator emissions, alone and in combination with the incinerator stack and fugitive emissions, should be determined;

- if the evaporator emissions are found to be significant, the implications of the evaporator emissions as related to air quality risks and impacts should be evaluated.

TABLE G.14

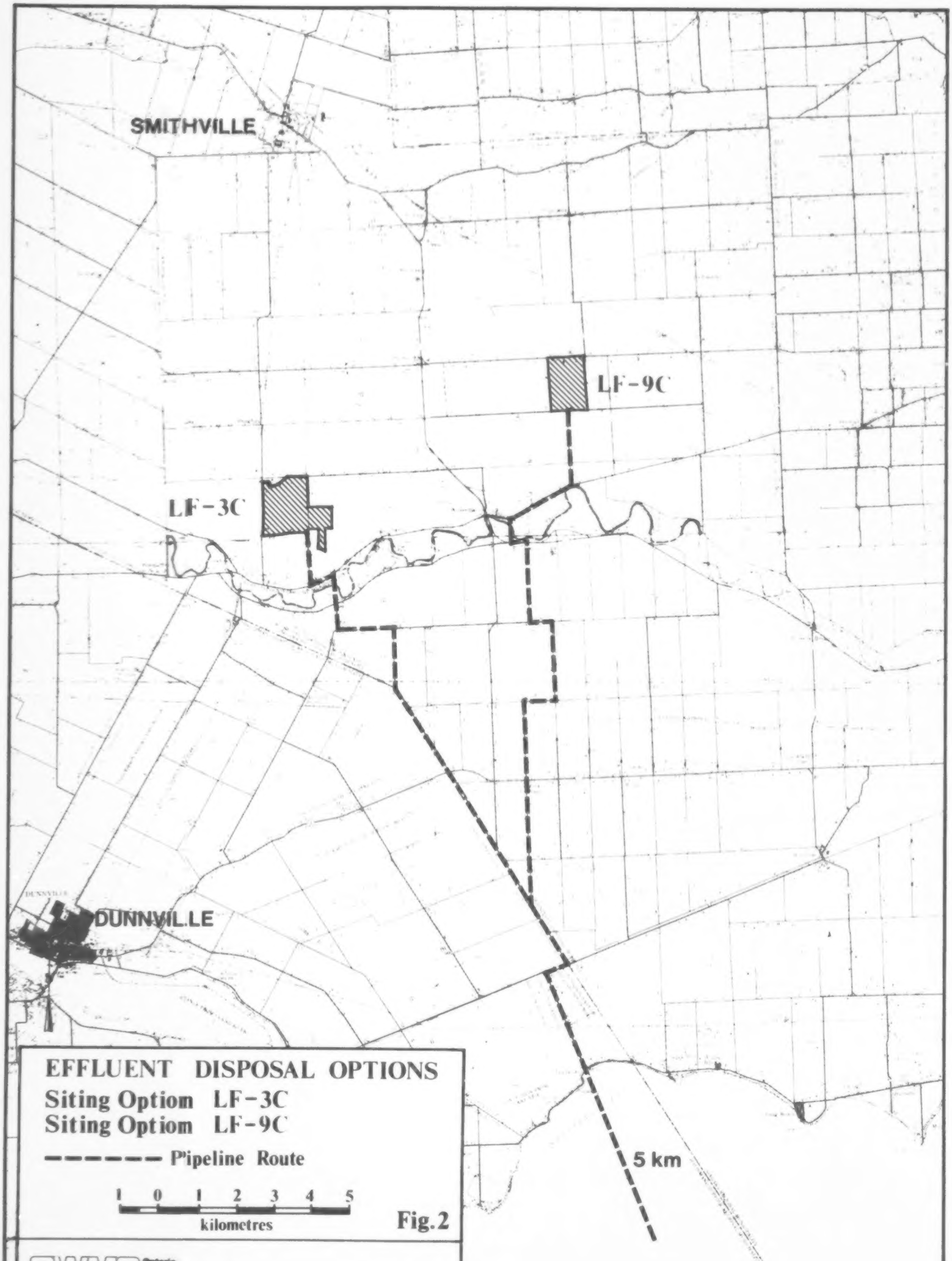
Ranking of Disposal Options on a Siting Option Basis

SITING OPTION	RANKING OF DISPOSAL OPTIONS	RATIONALE FOR RANKING
LF-3C	1. Evaporation 2. Pipeline 3. Trucking	o negligible off-site impacts for evaporation o pipeline outfall located in a cottage area; may have a high perceived impact and risk o trucking has a long haul distance to STP, passes numerous community and recreation features and a number of communities
LF-9C	1. Evaporation 2. Pipeline 3. Trucking	o negligible off-site impacts for evaporation o pipeline outfall located in a cottage area may have a high perceived impact and risk o truck route passes a number of community and recreation features, has a relatively long haul distance to STP
LF-1E	1. Evaporation 2. Pipeline Alternative A 3. Pipeline Alternative B and Trucking	o negligible off-site impacts for evaporation o pipeline alternative A outfall located in a rural area with some residential development east of outfall o pipeline alternative B outfall located in a cottage community o of the truck route, only approximately 6 km off 400-series highway but 4 km are located in a built-up area of St. Catharines. Route passes a number of recreation and community features in St. Catharines
LF-4N/PI-13N	1. Evaporation 2. Pipeline 3. Trucking	o negligible off-site impacts for evaporation o residential and recreational area at pipeline outfall; may have a high perceived risk or impact o truck passes through Oakville (¼ of route) and a high number of recreation and community features
LF-4N/PI-1N	1. Evaporation 2. Pipeline 3. Trucking	o negligible off-site impacts for evaporation o residential and recreational area at pipeline outfall; may have a high perceived risk or impact o truck route passes through Oakville (¼ of route) and a high number of recreation and community features
LF-4N/PI-27E	1. Evaporation 2. Pipeline Alternative A 3. Pipeline Alternative B and Trucking	o negligible off-site impacts for evaporation o pipeline alternative A outfall located in a rural area with some residential development east of outfall o pipeline alternative B outfall located in a cottage community o of the truck route, only approximately 6 km off 400-series highway but 4 km are located in four built-up areas of St. Catharines; route passes a number of recreation community features in St. Catharines


Baker Rd
STP
GRIMSBY
QEW
LINCOLN
SMITHVILLE
LF-9C
LF-3C
N
Truck Route
1 0 1 2 3 4 5
kilometres
OWMC Ontario Waste Management Corporation
DILLON

EFFLUENT DISPOSAL OPTIONS
Siting Option LF-3C
Siting Option LF-9C

Fig.1



SMITHVILLE
LF-9C
LF-3C
DUNNVILLE
5 km
1 0 1 2 3 4 5
kilometres

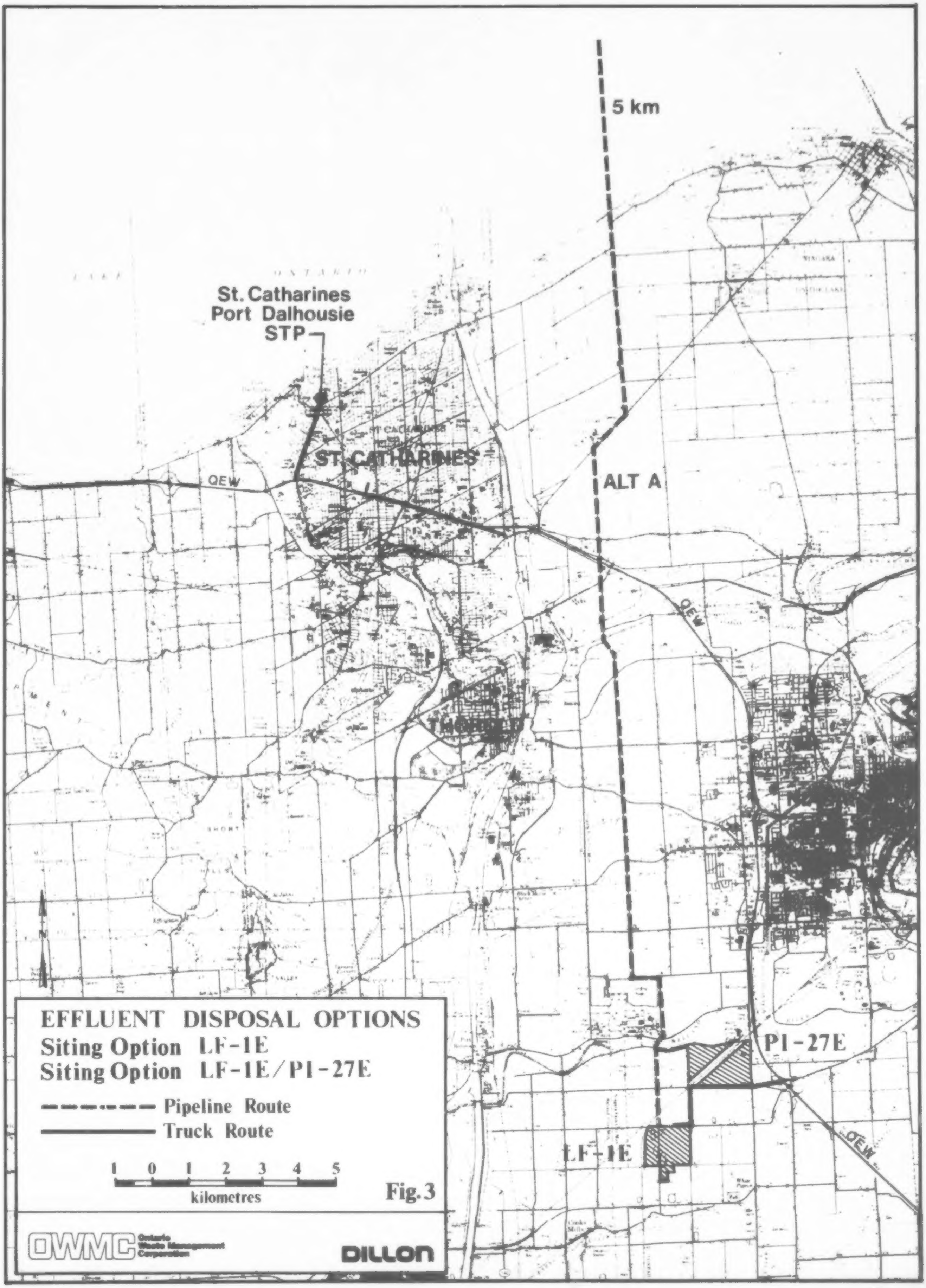
EFFLUENT DISPOSAL OPTIONS
Siting Optiom LF-3C
Siting Optiom LF-9C

------ Pipeline Route

Fig. 2

OWMC Ontario Waste Management Corporation

DILLON


5 km
LAKE ONTARIO
St. Catharines
Port Dalhousie
STP
ST. CATHARINES
QEW
ALT A
NIAGARA ON THE LAKE
QEW
THOROLD
PI-27E
LF-1E
QEW
N
1 0 1 2 3 4 5
kilometres

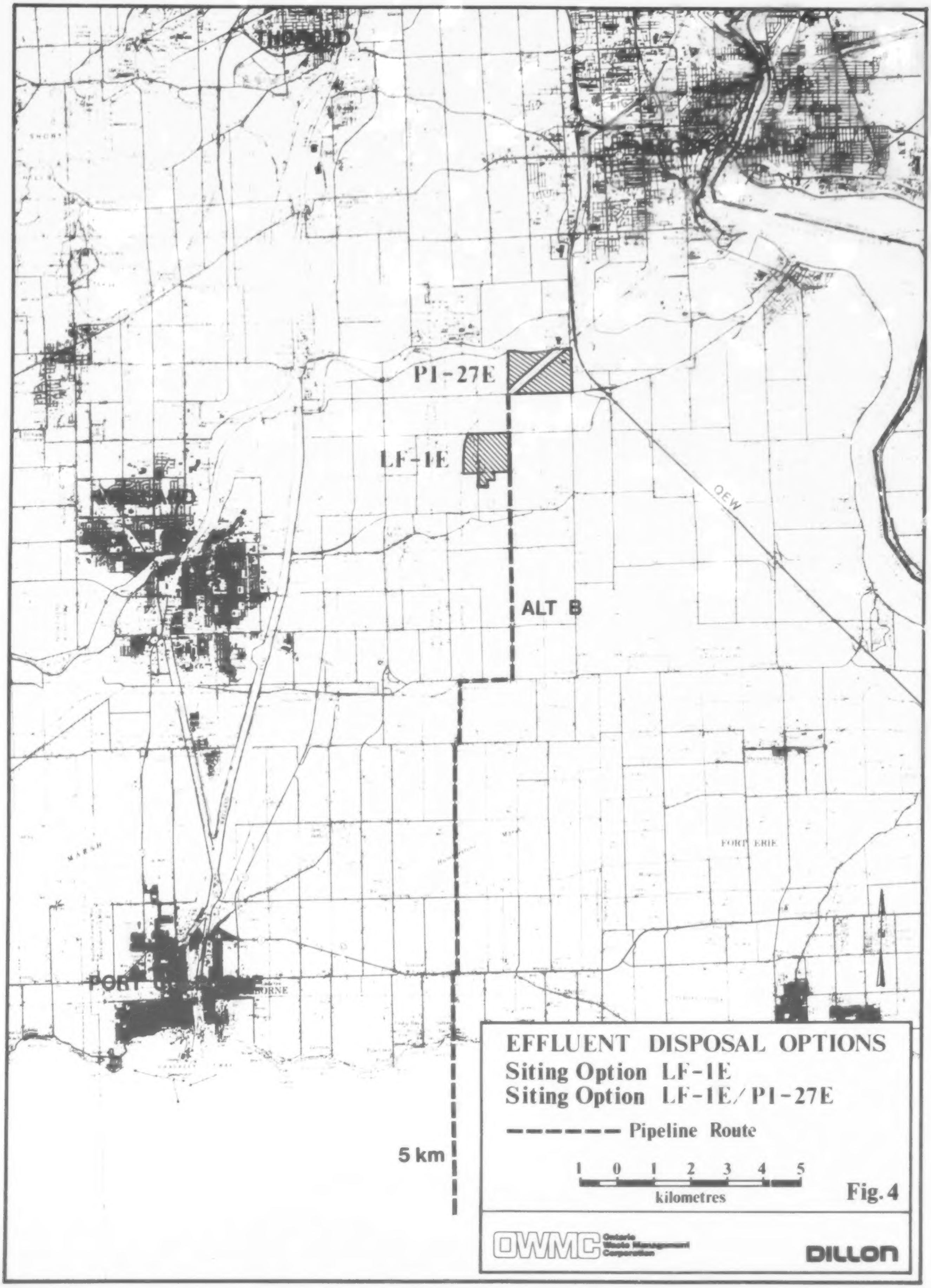
EFFLUENT DISPOSAL OPTIONS
Siting Option LF-1E
Siting Option LF-1E/PI-27E

- - - - - - Pipeline Route
———— Truck Route

Fig. 3

OWMC Ontario Waste Management Corporation

DILLON


THOROLD
SHORT
PI-27E
LF-1E
WELLAND
ALT B
QEW
MARSH
FORT ERIE
PORT COLBORNE
5 km
1 0 1 2 3 4 5
kilometres

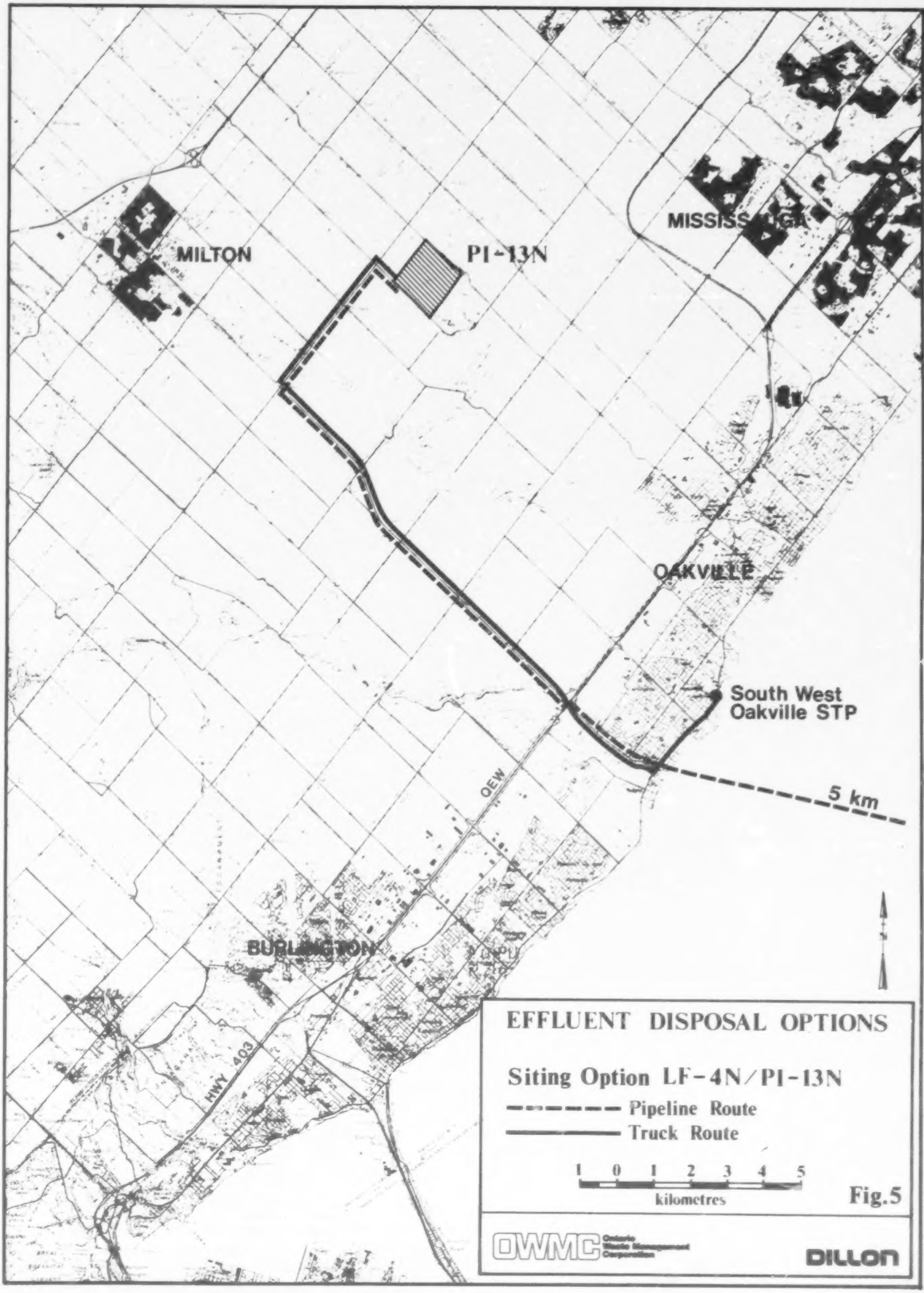
EFFLUENT DISPOSAL OPTIONS
Siting Option LF-1E
Siting Option LF-1E/PI-27E

- - - - - - Pipeline Route

Fig. 4

OWMC Ontario Waste Management Corporation

DILLON

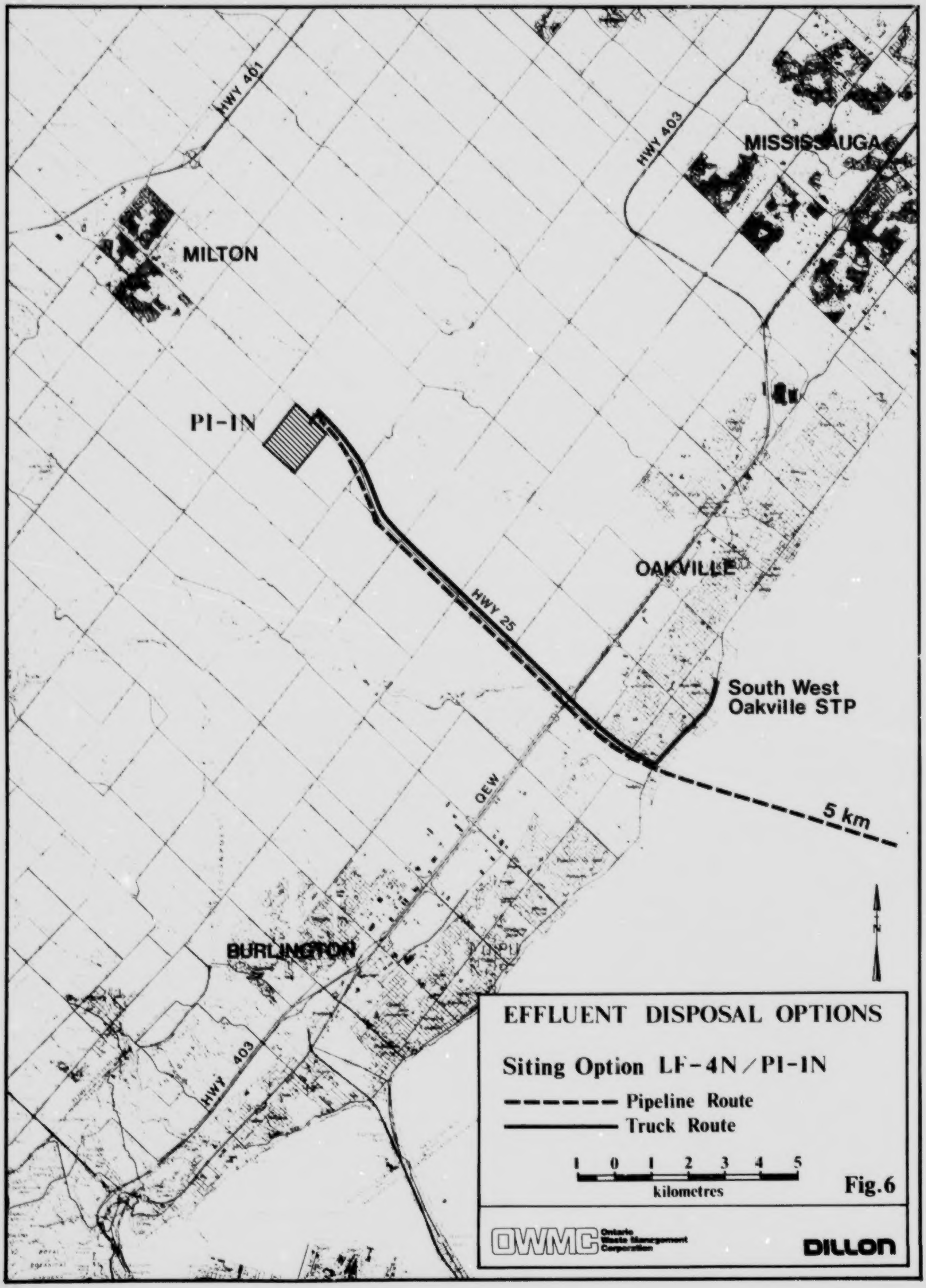


EFFLUENT DISPOSAL OPTIONS

Siting Option LF-4N/PI-13N

Fig.5

MILTON
PI-13N
MISSISSAUGA
OAKVILLE
South West Oakville STP
5 km
QEW
BURLINGTON
HWY 403
Pipeline Route
Truck Route
1 0 1 2 3 4 5
kilometres
OWMC Ontario Waste Management Corporation
DILLON


HWY 401
HWY 403
MISSISSAUGA
MILTON
PI-1N
OAKVILLE
HWY 25
South West
Oakville STP
5 km
QEW
BURLINGTON
HWY 403
N
Pipeline Route
Truck Route
1 0 1 2 3 4 5
kilometres
OWMC Ontario Waste Management Corporation
DILLON

EFFLUENT DISPOSAL OPTIONS

Siting Option LF-4N / PI-1N

Fig.6

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APPENDIX H

(Appendix to Chapter 8)

OWMC PHASE 4B - TRANSPORTATION
SENSITIVITY OF TRANSPORTATION RISK ANALYSIS TO INCLUSION OF RECEPTORS ALONG QEW FROM NIAGARA ROAD 24 TO NIAGARA ROAD 47

March 1986
9924-31-3

M.M. DILLON LTD.

1. INTRODUCTION

During the Phase 4A analysis two transportation risk factors were derived to represent the risk of a spill or accident involving the road transport of special wastes and treatment materials on the surrounding population, land uses, and environment. At that stage of the analysis it was reasoned that the study area for this type of analysis should be restricted to the selected local and regional access roads (i.e. those roads selected for accessing the site from the freeway system).

This study determines the sensitivity of the transportation risk component of the Phase 4A analysis to the expansion of the study area for risk receptors to include portions of the freeway system.

Three siting options were selected for this analysis: LF-9C and LF-3C in the Township of West Lincoln, and LF-1E/PI-27E, in the City of Niagara Falls. As described in Chapter 8, the Phase 4A sensitivity analysis focused on assumption changes which might affect the ranking of the Niagara Falls and West Lincoln siting options.

The study was initially undertaken in response to a concern raised by the Township of West Lincoln. The Township representatives indicated that the heavily travelled portion of the QEW between Regional Road 24 and Regional Road 47 could be treated as a local regional road, particularly since access to the Niagara Falls siting options was fairly direct from the QEW. The Township also indicated that risk receptors were located in close proximity to the QEW along this stretch of highway.

The risk receptor study area was expanded to include the section of the QEW from Niagara Regional Road 24 to Niagara Regional Road 47. This expanded study area was considered as part of the local and regional access system. This section of QEW represents the additional length of the freeway system which must be travelled to reach site LF-1E/PI-27E in comparison to the West Lincoln sites.

2. STUDY METHODOLOGY AND DATA SOURCES

The data sources and methodology applied to calculate the risk indices were similar to the methodology applied in the Phase 4A Transportation Analysis outlined in Chapter 8 of the 1985 M.M. Dillon Report, Site Selection Process Phase 4A: Selection of a Preferred Site(s) - Transportation. However, the analysis did not include indirect risk pathways such as surface water, and hydrogeologic sensitive lands[1]. The following receptors were included: population, sensitive uses, and road users.

The expansion of the study area only affected the risk indices for site LF-1E/P1-27E. No wastes or additives/ reagents approach sites LF-9C or LF-3C from east of Regional Road 24 on the QEW. Essentially the province-wide risk indices are the same for all sites, the only difference being the travel on Highway 20 from the St. Catherines/Niagara waste centroid.

To facilitate the collection of data for the expanded risk receptor study area, the QEW was divided into 15 discrete sections of roadway corresponding to the limits of accident data collected by MTC and published in their report Provincial Highway: Traffic Volumes - 1982. The 1982 report was used to correspond to the date of the accident data applied in this analysis (i.e. Phase 4A analysis used 1980 to 1982 accident data).

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1. The Phase 4A Transportation analysis undertaken by M.M. Dillon Limited tested the sensitivity of the transportation risk rankings to the elimination of the indirect risk pathways on local and regional access roads. It was concluded "that indirect transportation risk pathways were only a minor contributor to the relative ranking of sites and did not exhibit as great a difference between sites as did some of the other potential risk indicators" (M.M. Dillon Ltd, 1985b, p.251)

3. STUDY RESULTS

The transportation risk indices for site LF-1E/PI-27E using the expanded risk receptor study area are detailed in Attachment A. The values for sites LF-9C and LF-3C are presented in Appendix B of the Phase 4A Transportation report (M.M. Dillon Limited 1985b). These values are summarized in Table 1.

In order to carry out a comparison similar to that of the Phase 4A analysis it was necessary to perform the same scaling and weighting as the previous study. The results of this analysis are presented in Tables 2 to 4. These tables correspond to Tables 8.7 to 8.9, respectively, of the Phase 4A Transportation Report.

As a result of the expansion of the risk receptor study area, the risk index values for siting option LF-1E/PI-27E are much higher than the values for the LF-9C and LF-3C siting options.

The values for indicators of risk due to spills on local and regional roads were all lower for siting options LF-9C and LF-3C in comparison to site LF-1E/PI-27E. The most significant difference pertained to the risk index representing road users. The road user risk index values for sites LF-9C and LF-3C were about 20% of the value for LF-1E/PI-27E. This indicator was of considerable importance when the indicators were aggregated.

The changes in rankings which occurred were a result of differences in accident rates, length of routes, and receptors along the routes to each site. The route to LF-1E/PI-27E from the interchange of QEW/Niagara Road 24 is 17.5 km longer than the route to LF-9C. Therefore there is a higher possibility of spills due to non-motor vehicle related

TABLE 1

(TABLE 8.5 FROM PHASE 4A REPORT)

FACTOR AND INDICATOR VALUES FOR LF-9C & PI-27E/LF-1E IN COMPARATIVE ANALYSIS

Factor	Indicator	LF-9C	LF-3C	PI-27E/LF-1E
1. Province Wide Hazard Based Spill Index	a) Spills Index Due to Motor Vehicle Accidents	3.226	3.226	3.672
	b) Spills Index due to Non-motor Vehicle Accidents	10.447	10.447	10.599
2. Risks due to Hazard Based Spills on Local and Regional Access Routes	a) Population Risk Index	11102.29	13512.9	18828.968
	b) Road User Risk Index	51.287	57.06	270.61
	c) Sensitive Uses Risk Index	12.247	12.247	19.303
3. Province-wide Accident Involvements	a) Annual Accident Involvements By OWMC Generated Trucks	4.36	4.36	4.81
4. Risks due to Accident Involvements on Local & Regional Access Routes	a) Road User Risk(1)	26.857	29.18	81.708

NOTES: 1. Values for road user index are divided by 1000.

TABLE 2

(TABLE 8.7 FROM PHASE 4A REPORT)

SCALING AND AGGREGATION OF HAZARD BASED SPILL RISK FACTORS AND INDICATORS

			Scaled Value and (Scaled Value x Weighting)		
FACTOR	INDICATOR	WEIGHT	LF-9C	LF-3C	PI-27E/LF-1E
1. Risks due to Spills on Local and Regional Access Routes	a) Risk to Population	5	0.590	0.720	1.000
	b) Risk to Road Users	4	0.190	0.210	1.000
	c) Risk to Sensitive Uses	3	0.634	0.664	1.000
	Aggregated Value for Factor:		5.612	6.360	12.000
	Factor Suitability Level:		-2.3	-2.7	-5.0
2. Province-wide Hazard Based Spill Index	a) Annual Accident Related Spills(1)	1	3.226	3.226	3.672
	b) Annual Non-accident Related Spills(1)	1	10.447	10.447	10.599
	Aggregated Value for Factor:		13.673	13.673	14.271
	Factor Suitability Level:		-4.8	-4.8	-5.0

NOTES: 1. Indicator values for province-wide factor were not scaled in order to preserve differences in frequency of occurance of the two types of spills. Therefore no "Scaled Value x Weighting" is shown.

TABLE 3
(TABLE 8.8 FROM PHASE 4A REPORT)
SCALING AND AGGREGATION OF ACCIDENT INVOLVEMENT RISK FACTORS AND INDICATORS

			Scaled Value and (Scaled Value x Weighting)		
FACTOR	INDICATOR	WEIGHT	LF-9C	LF-3C	PI-27E/LF-1E
1. Risk due to Accident Involvement on Local and Regional Access Roads	a) Risk to Road Users	1	0.329	0.360	1.000
	Factor Suitability Level:		-1.6	-1.8	-5.0
2. Province-wide Annual Accident Involvement	a) Annual Accident Involvement	1	0.91	0.91	1.00
	Factor Suitability Level:		-4.5	-4.5	-5.0

TABLE 4
(TABLE B.9 FROM PHASE 4A REPORT)
AGGREGATION OF TRANSPORTATION RISK FACTORS

		Factor Suitability		
Factor	Weight	LF-9C	LF-3C	PI-27E/LF-1E
1. Province Wide Hazard Based Spill Index	8	-4.8	-4.8	-5.0
2. Spill Risks on Local and Regional Roads	10	-2.3	-2.7	-5.0
Aggregated Value for Spill Factors:		-61.4	-64.9	-90.0
Site Option Ranking		1ST	2ND	3RD
3. Province Wide Accident Involvements	8	-4.5	-4.5	-5.0
4. Accident Involment Risks on Local & Regional Roads	10	-1.6	-1.8	-5.0
Aggregated Value for Accident Involvement Factors		-52.0	-54.4	-90.0
Site Option Ranking		1ST	2ND	3RD
Aggregated Value for All Factors:		-113.4	-119.3	-180.0
Site Option Ranking		1ST	2ND	3RD

accidents on the route to site LF-1E/PI-27E than to LF-9C. The composite accident rates (accidents per million vehicles) along the route to LF-1E/PI-27E is within 2 percent of the value for site LF-9C. Therefore the number of spills due to motor vehicle accidents are almost the same.

The risk receptor study area for LF-3C is only 7 kilometres shorter than that to LF-1E/PI-27E. The number of accidents per million vehicle kilometres for site LF-1E/PI-27E is 25% less than LF-3C. Despite these differences, however, the transport risk indices for the two sites strongly favour LF-3C due largely to differences in the number of risk receptors in the two study areas.

There are also significant differences in the number of risk receptors along each route. The annual average daily traffic (road users) ranges between 20,600 and 52,400 along the QEW between Niagara Road 24 and Niagara Road 47. For sites LF-9C and LF-3C, the number of road users is between 50 and 16,200. Similarly there are more residents and sensitive land uses within the QEW risk corridors than there are for the route to LF-9C. It should be noted that along the QEW a larger concentration of population and land use receptors is located within the 150-500 m risk corridor than in the 0-150 m corridor. For sites LF-9C and LF-3C the 0-150 m corridor contains more receptors.

In terms of the province-wide risk indices, siting options LF-9C and LF-3C are slightly superior to option LF-1E/PI-27E. This is due to the differences in distance and routings from the St. Catherines waste centroid to the different treatment sites. The remainder of the province-wide system is essentially the same for all siting options.

4. SUMMARY AND CONCLUSIONS

This sensitivity analysis has led to the following conclusions regarding the Phase 4A transportation risk analysis:

1. The transportation risk index values for site LF-1E/PI-27E increase when the risk receptor study area is expanded to include the section of the QEW from Niagara Road 24 to Niagara Road 47, while reducing the province-wide study area by the same distance.

2. Siting option LF-1E/PI-27E with the expanded risk receptor study area, ranks lower than siting option LF-9C and LF-3C in terms of transportation risks.

3. The expanded local and regional route to LF-1E/PI-27E from QEW/Niagara Road 24 interchange is 17.5 km longer than the route to LF-9C, although the expected number of accidents per million vehicles is virtually the same. There are significantly more risk receptors along the QEW route than the routes to LF-9C and LF-3C, especially road users and population.

4. The majority of the population and land use receptors along the QEW are located in the 150-500 m risk corridor. The majority of the receptors along the routes to LF-9C and LF-3C are located in the 0-150 m corridor.

ATTACHMENT A
TO
APPENDIX H

TRANSPORTATION RISK INDICES FOR SITE LF-1E/PI-27E
Using Expanded Risk Receptor
Study Area

OWMC PHASE 4A - TRANSPORTATION

SCENARIO 2. TOTAL SOLIDIFICATION

TABLE A-1: LOCAL AND REGIONAL ACCESS ROAD USER RISK LINK DATA - PI-27E/LF-1E CASE 2 (1)

LINK DESCRIPTION	LENGTH (km)	ALL VEHICLE 1980-1982 ACC./MVkm	ALL VEHICLE ACCIDENTS PER M.V.	MATERIAL	OWMC ANNUAL ONE-WAY VEHICLE MOVEMENTS (2)	TWO-WAY OWMC ANNUAL ACCIDENT INVOLVMENT (3)	ANNUAL NUMBER OF SPILLS NON ACCIDENT RELATED (4)	ANNUAL NUMBER OF SPILLS ACCIDENT RELATED (5)	ANNUAL NUMBER OF SPILLS TOTAL	YEAR 2000 A.A.D.T. (veh.)	RECEPTOR INDICES: A.A.D.T. (6,7,8,9) ACCIDENT INVOLVEMENT INDEX	RECEPTOR INDICES: A.A.D.T. (6,7,8,9) TOTAL SPILL INDEX	TOTAL INDEX
A. REGIONAL ROAD 47 (BIGGAR ROAD /LYON'S CREEK ROAD)													
1. QEW to RR. 98	0.4	2.3	0.92	Special Wastes	19552	0.081	0.008	0.008	0.016	4650	374.723	730.895	1105.618
				Additives & Reagents	2634	0.011	0.001	0.001	0.002		50.482	9.846	60.328
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000		0.000	0.000	0.000
				TOTAL	22186	0.091	0.009	0.009	0.018		425.204	740.742	1165.946
2. RR. 98 to PI-27E	0.8	1.3	1.04	Special Wastes	19552	0.091	0.016	0.009	0.025	1700	154.864	417.674	572.539
				Additives & Reagents	2634	0.012	0.002	0.001	0.003		20.863	5.627	26.490
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000		0.000	0.000	0.000
				TOTAL	22186	0.103	0.018	0.010	0.028		175.727	423.301	599.028
3. PI-27E to Crowland Rd.	0.9	1.3	1.17	Special Wastes	0	0.000	0.000	0.000	0.000	1700	0.000	0.000	0.000
				Additives & Reagents	0	0.000	0.000	0.000	0.000		0.000	0.000	0.000
				Inter-Site Transfers	14274	0.075	0.013	0.007	0.020		127.192	34.304	161.496
				TOTAL	14274	0.075	0.013	0.007	0.020		127.192	34.304	161.496
B. CROWLAND ROAD (LOCAL)													
1. RR. 47 to Carl Rd.	1	1.61	1.61	Special Wastes	0	0.000	0.000	0.000	0.000	50	0.000	0.000	0.000
				Additives & Reagents	0	0.000	0.000	0.000	0.000		0.000	0.000	0.000
				Inter-Site Transfers	14274	0.103	0.014	0.010	0.024		5.148	1.218	6.366
				TOTAL	14274	0.103	0.014	0.010	0.024		5.148	1.218	6.366
C. CARL ROAD (LOCAL)													
1. Crowland Rd. to Morris Rd.	0.8	1.61	1.29	Special Wastes	0	0.000	0.000	0.000	0.000	260	0.000	0.000	0.000
				Additives &.Reagents	0	0.000	0.000	0.000	0.000		0.000	0.000	0.000
				Inter-Site Transfers	14274	0.082	0.011	0.008	0.019		21.415	5.068	26.482
				TOTAL	14274	0.082	0.011	0.008	0.019		21.415	5.068	26.482
D. Q.E.W.													
1. RR. 24 to RR. 26	2.7	0.92	2.48	Special Waste	13100	0.146	0.035	0.014	0.050	48900	37.903	24282.047	24319.950
				Additives &Reagents	2634	0.029	0.007	0.003	0.010		7.621	488.236	495.857
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000		0.000	0.000	0.000
				TOTAL	15734	0.175	0.042	0.017	0.060		45.524	24770.283	24815.807
2. RR. 26 to RR. 34	4.4	0.88	3.87	Special Waste	13100	0.227	0.058	0.022	0.080	46500	10566.657	37157.924	47724.581
				Additives &Reagents	2634	0.046	0.012	0.004	0.016		2124.624	747.130	2871.754
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000		0.000	0.000	0.000
				TOTAL	15734	0.273	0.069	0.027	0.096		12691.281	37905.053	50596.334
3. RR.34 to HWY 406	1.7	1.27	2.16	Special Waste	13100	0.127	0.022	0.012	0.035	40100	5080.966	13909.617	18990.584
				Additives &Reagents	2634	0.025	0.004	0.002	0.007		1021.623	279.679	1301.302
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000		0.000	0.000	0.000
				TOTAL	15734	0.152	0.027	0.015	0.042		6102.590	14189.296	20291.886
4. HWY 406 to RR. 38	1	1.29	1.29	Special Waste	13100	0.076	0.013	0.007	0.021	42000	3179.716	8618.122	11797.837
				Additives &Reagents	2634	0.015	0.003	0.001	0.004		639.341	173.283	812.625
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000		0.000	0.000	0.000
				TOTAL	15734	0.091	0.016	0.009	0.025		3819.057	8791.405	12610.462

OWMC PHASE 4A - TRANSPORTATION

SCENARIO 2, TOTAL SOLIDIFICATION

TABLE A-1: LOCAL AND REGIONAL ACCESS ROAD USER RISK LINK DATA - PI-27E/LF-1E CASE 2 (1)

LINK DESCRIPTION	LENGTH (km)	ALL VEHICLE 1980-1982 ACC./MVkm	ALL VEHICLE ACCIDENTS PER M.V.	MATERIAL	OWMC ANNUAL ONE-WAY VEHICLE MOVEMENTS (2)	TWO-WAY OWMC ANNUAL ACCIDENT INVOLVMENT (3)	ANNUAL NUMBER OF SPILLS NON ACCIDENT RELATED (4)	ANNUAL NUMBER OF SPILLS ACCIDENT RELATED (5)	ANNUAL NUMBER OF SPILLS TOTAL	YEAR 2000 A.A.D.T. (veh.)	RECEPTOR INDICES: A.A.D.T. (6,7,8,9) ACCIDENT INVOLVEMENT INDEX	RECEPTOR INDICES: TOTAL SPILL INDEX	TOTAL INDEX
5. RR. 38 to Ontario St.	0.8	0.89	0.71	Special Waste	13100	0.042	0.010	0.004	0.015	52400	2189.579	7637.307	9826.886
				Additives &Reagents	2634	0.008	0.002	0.001	0.003		440.256	153.562	593.818
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000		0.000	0.000	0.000
				TOTAL	15734	0.050	0.013	0.005	0.018		2629.835	7790.870	10420.704
6. Ontario St. to Lake St.	1.2	0.67	0.80	Special Waste	13100	0.047	0.016	0.005	0.020	48500	2288.480	9866.910	12155.390
				Additives &Reagents	2634	0.009	0.003	0.001	0.004		460.142	198.393	658.534
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000		0.000	0.000	0.000
				TOTAL	15734	0.057	0.019	0.006	0.024		2748.622	10065.303	12813.925
7. Lake St. to Niagara St.	1.7	0.96	1.63	Special Waste	13100	0.096	0.022	0.009	0.032	48200	4616.539	15258.348	19874.887
				Additives &Reagents	2634	0.019	0.004	0.002	0.006		928.241	306.798	1235.039
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000		0.000	0.000	0.000
				TOTAL	15734	0.115	0.027	0.011	0.038		5544.780	15565.146	21109.926
8. Niagara St. to Service Rd.	1.3	0.90	1.17	Special Waste	13100	0.069	0.017	0.007	0.024	37400	2568.070	8885.928	11453.998
				Additives &Reagents	2634	0.014	0.003	0.001	0.005		516.358	178.668	695.027
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000		0.000	0.000	0.000
				TOTAL	15734	0.082	0.020	0.008	0.029		3084.428	9064.596	12149.024
9. Service Rd. to Glendale Ave	4.5	1.13	5.09	Special Waste	13100	0.298	0.059	0.029	0.088	46500	13876.924	41011.136	54888.060
				Additives &Reagents	2634	0.060	0.012	0.006	0.018		2790.215	824.606	3614.821
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000		0.000	0.000	0.000
				TOTAL	15734	0.358	0.071	0.035	0.106		16667.139	41835.741	58502.881
10. Glendale Ave. to HWY 405	1.3	0.93	1.21	Special Waste	13100	0.071	0.017	0.007	0.024	47600	3377.400	11416.132	14793.533
				Additives &Reagents	2634	0.014	0.003	0.001	0.005		679.090	229.543	908.632
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000		0.000	0.000	0.000
				TOTAL	15734	0.085	0.020	0.008	0.029		4056.490	11645.675	15702.165
11. HWY 405 to RR. 101	2.6	0.99	2.57	Special Waste	13100	0.151	0.034	0.015	0.049	39900	6027.410	19496.802	25524.212
				Additives &Reagents	2634	0.030	0.007	0.003	0.010		1211.924	392.020	1603.943
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000		0.000	0.000	0.000
				TOTAL	15734	0.181	0.041	0.018	0.059		7239.334	19888.822	27128.155
12. RR. 101 to RR. 57	2.4	0.82	1.97	Special Waste	13100	0.115	0.031	0.011	0.043	47100	5439.955	20139.396	25579.351
				Additives &Reagents	2634	0.023	0.006	0.002	0.009		1093.805	404.940	1498.745
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000		0.000	0.000	0.000
				TOTAL	15734	0.139	0.038	0.014	0.051		6533.760	20544.336	27078.096
13. RR. 57 to HWY 420	1.9	0.52	0.99	Special Waste	13100	0.058	0.025	0.006	0.031	43700	2533.890	13360.142	15894.031
				Additives &Reagents	2634	0.012	0.005	0.001	0.006		509.486	268.631	778.117
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000		0.000	0.000	0.000
				TOTAL	15734	0.070	0.030	0.007	0.037		3043.376	13628.772	16672.148

OWMC PHASE 4A - TRANSPORTATION

SCENARIO 2, TOTAL SOLIDIFICATION

TABLE A-1: LOCAL AND REGIONAL ACCESS ROAD USER RISK LINK DATA - PI-27E/LF-1E CASE 2 (1)

LINK DESCRIPTION	LENGTH (km)	ALL VEHICLE 1980-1982 ACC./MVkm	ALL VEHICLE ACCIDENTS PER M.V.	MATERIAL	OWMC ANNUAL ONE-WAY VEHICLE MOVEMENTS (2)	TWO-WAY OWMC ANNUAL ACCIDENT INVOLVMENT (3)	ANNUAL NUMBER OF SPILLS NON ACCIDENT RELATED (4)	ANNUAL NUMBER OF SPILLS ACCIDENT RELATED (5)	ANNUAL NUMBER OF SPILLS TOTAL	YEAR 2000 A.A.D.T. (veh.)	RECEPTOR INDICES: A.A.D.T. (6,7,8,9) ACCIDENT INVOLVEMENT INDEX	RECEPTOR INDICES: A.A.D.T. (6,7,8,9) TOTAL SPILL INDEX	RECEPTOR INDICES: A.A.D.T. (6,7,8,9) TOTAL INDEX
14. HWY 420 to RR. 49	3.1	0.57	1.77	Special Waste	13100	0.104	0.041	0.010	0.051	23100	2395.509	11728.509	14124.018
				Additives &Reagents	2634	0.021	0.008	0.002	0.010		481.662	235.824	717.486
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000		0.000	0.000	0.000
				TOTAL	15734	0.125	0.049	0.012	0.061		2877.171	11964.333	14841.504
15. RR. 49 to RR. 47	4.5	0.42	1.89	Special Waste	19552	0.166	0.088	0.016	0.104	20600	3410.344	21466.841	24877.186
				Additives &Reagents	2634	0.022	0.012	0.002	0.014		459.434	289.196	748.630
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000		0.000	0.000	0.000
				TOTAL	22186	0.188	0.100	0.018	0.118		3869.778	21756.038	25625.816

SUMMARY TABLE	LENGTH (km)		ACCIDENTS PER MV.	MATERIAL	OWMC ANNUAL ONE-WAY VEHICLE REQUIREMENTS	TWO-WAY OWMC ANNUAL ACCIDENT INVOLVMENT (3)	ANNUAL NUMBER OF SPILLS NON ACCIDENT RELATED (4)	ANNUAL NUMBER OF SPILLS ACCIDENT RELATED (5)	ANNUAL NUMBER OF SPILLS TOTAL	VEHICLE KILOMETERS	RECEPTOR INDEX: A.A.D.T. TOTAL ACCIDENT INVOLVEMENT INDEX	RECEPTOR INDEX: A.A.D.T. TOTAL SPILL INDEX	TOTAL INDEX
ACCESS ROUTE TOTALS FOR SITE OPTION PI-27E/LF-1E CASE 2	39.0		35.63	Special Wastes	19552	1.964	0.512	0.192	0.705	512306			
				Additives &Reagents	2634	0.372	0.096	0.037	0.132	95614	81707.850	270610.302	352318.15
				Inter-Site Transfers	14274	0.260	0.039	0.025	0.064	38540			
				TOTAL	36460	2.596	0.646	0.254	0.901	646460			

Notes: 1. Based upon the receipt of 300,000 t/a of special waste and includes the process reagents and additives required to treat this quantity.
2. Based upon the revised total solidification treatment process defined by Monenco Limited, Febuary/March 1985.
3. Derived from all vehicle accident rate using a factor of 2.24.
4. Based on one spill per MVkm..
5. Derived using a conditional probability of 0.196, applied to one-way OWMC annual accident involvment.
6. The Accident Involvement Index is the product of the "Two-Way OWMC Annual Accident Involvement " and the "Year 2000 A.A.D.T..
7. The Total Spill Index is the product of the "Total Annual Number of Spills" , the Year 2000 A.A.D.T. and the "Hazard Index".
8. The Hazard Indices for the transported materials are, 10 for Special Waste and 1 for Additives & Reagents and Inter-site Transfers.
9. The "Receptor Indices" and link totals have been rounded for display.

OWMC PHASE 4A - TRANSPORTATION

SCENARIO 2, TOTAL SOLIDIFICATION

TABLE A-2: LOCAL AND REGIONAL ACCESS ROAD RISK LINK DATA FOR NUMBER OF RESIDENTS - PI-27E/LF-1E CASE 2 (1)

LINK DESCRIPTION	LENGTH (km)	ALL VEHICLE		MATERIAL	OWMC ANNUAL ONE-WAY VEHICLE MOVEMENTS (2)	TWO-WAY OWMC ANNUAL ACCIDENT INVOLVMENT (3)	ANNUAL NUMBER OF SPILLS			NO. OF RESIDENTS		RECEPTOR INDEX: RESIDENTS	
		1980-1982 ACC./MVkm	ACCIDENTS PER M.V.				NON ACCIDENT RELATED (4)	ACCIDENT RELATED (5)	TOTAL	0 - 150 (m)	150 - 500 (m)	0 - 150 (m) (6,7,8)	150 - 500 (m) (6,7,8)
A. REGIONAL ROAD 47 (BIGGAR ROAD /LYON'S CREEK ROAD)													
1. QEW to RR. 98	0.4	2.3	0.92	Special Wastes	19552	0.081	0.008	0.008	0.016	0	0	0.000	0.000
				Additives & Reagents	2634	0.011	0.001	0.001	0.002			0.000	0.000
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	22186	0.091	0.009	0.009	0.018			0.000	0.000
2. RR. 98 to PI-27E	0.8	1.3	1.04	Special Wastes	19552	0.091	0.016	0.009	0.025	6	6	1.474	1.474
				Additives & Reagents	2634	0.012	0.002	0.001	0.003			0.020	0.020
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	22186	0.103	0.018	0.010	0.028			1.494	1.494
3. PI-27E to Crowland Rd.	0.9	1.3	1.17	Special Wastes	0	0.000	0.000	0.000	0.000	0	0	0.000	0.000
				Additives & Reagents	0	0.000	0.000	0.000	0.000			0.000	0.000
				Inter-Site Transfers	14274	0.075	0.013	0.007	0.020			0.000	0.000
				TOTAL	14274	0.075	0.013	0.007	0.020			0.000	0.000
B. CROWLAND ROAD (LOCAL)													
1. RR. 47 to Carl Rd.	1	1.61	1.61	Special Wastes	0	0.000	0.000	0.000	0.000	3	0	0.000	0.000
				Additives & Reagents	0	0.000	0.000	0.000	0.000			0.000	0.000
				Inter-Site Transfers	14274	0.103	0.014	0.010	0.024			0.073	0.000
				TOTAL	14274	0.103	0.014	0.010	0.024			0.073	0.000
C. CARL ROAD (LOCAL)													
1. Crowland Rd. to Morris Rd.	0.8	1.61	1.29	Special Wastes	0	0.000	0.000	0.000	0.000	0	0	0.000	0.000
				Additives & Reagents	0	0.000	0.000	0.000	0.000			0.000	0.000
				Inter-Site Transfers	14274	0.082	0.011	0.008	0.019			0.000	0.000
				TOTAL	14274	0.082	0.011	0.008	0.019			0.000	0.000
D. Q.E.W.													
1. RR. 24 to RR. 26	2.7	0.92	2.48	Special Waste	13100	0.146	0.035	0.014	0.050	64	102	31.780	50.650
				Additives &Reagents	2634	0.029	0.007	0.003	0.010			0.639	1.018
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	15734	0.175	0.042	0.017	0.060			32.419	51.668
2. RR. 26 to RR. 34	4.4	0.88	3.87	Special Waste	13100	0.227	0.058	0.022	0.080	227	208	181.395	166.212
				Additives &Reagents	2634	0.046	0.012	0.004	0.016			3.647	3.342
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	15734	0.273	0.069	0.027	0.096			185.042	169.554
3. RR.34 to HWY 406	1.7	1.27	2.16	Special Waste	13100	0.127	0.022	0.012	0.035	22	112	7.631	38.850
				Additives &Reagents	2634	0.025	0.004	0.002	0.007			0.153	0.781
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	15734	0.152	0.027	0.015	0.042			7.785	39.631
4. HWY 406 to RR. 38	1	1.29	1.29	Special Waste	13100	0.076	0.013	0.007	0.021	3	0	0.616	0.000
				Additives &Reagents	2634	0.015	0.003	0.001	0.004			0.012	0.000
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	15734	0.091	0.016	0.009	0.025			0.628	0.000

OWMC PHASE 4A - TRANSPORTATION

SCENARIO 2, TOTAL SOLIDIFICATION

TABLE A-2: LOCAL AND REGIONAL ACCESS ROAD RISK LINK DATA FOR NUMBER OF RESIDENTS - PI-27E/LF-1E CASE 2 (1)

LINK DESCRIPTION	LENGTH (km)	ALL VEHICLE		MATERIAL	OWMC ANNUAL ONE-WAY VEHICLE MOVEMENTS (2)	TWO-WAY OWMC ANNUAL ACCIDENT INVOLVMENT (3)	ANNUAL NUMBER OF SPILLS			NO. OF RESIDENTS		RECEPTOR INDEX: RESIDENTS	
		1980-1982 ACC./MVkm	ACCIDENTS PER M.V.				NON ACCIDENT RELATED (4)	ACCIDENT RELATED (5)	TOTAL	0 - 150 (m)	150 - 500 (m)	0 - 150 (m) (6,7,8)	150 - 500 (m) (6,7,8)
5. RR. 38 to Ontario St.	0.8	0.89	0.71	Special Waste	13100	0.042	0.010	0.004	0.015	70	81	10.203	11.806
				Additives &Reagents	2634	0.008	0.002	0.001	0.003			0.205	0.237
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	15734	0.050	0.013	0.005	0.018			10.408	12.043
6. Ontario St. to Lake St.	1.2	0.67	0.80	Special Waste	13100	0.047	0.016	0.005	0.020	508	2084	103.348	423.972
				Additives &Reagents	2634	0.009	0.003	0.001	0.004			2.078	8.525
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	15734	0.057	0.019	0.006	0.024			105.426	432.497
7. Lake St. to Niagara St.	1.7	0.96	1.63	Special Waste	13100	0.096	0.022	0.009	0.032	672	2984	212.730	944.625
				Additives &Reagents	2634	0.019	0.004	0.002	0.006			4.277	18.993
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	15734	0.115	0.027	0.011	0.038			217.008	963.618
8. Niagara St. to Service Rd.	1.3	0.90	1.17	Special Waste	13100	0.069	0.017	0.007	0.024	694	2111	164.889	501.556
				Additives &Reagents	2634	0.014	0.003	0.001	0.005			3.315	10.085
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	15734	0.082	0.020	0.008	0.029			168.204	511.641
9. Service Rd. to Glendale Ave	4.5	1.13	5.09	Special Waste	13100	0.298	0.059	0.029	0.088	44	455	38.806	401.292
				Additives &Reagents	2634	0.060	0.012	0.006	0.018			0.780	8.069
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	15734	0.358	0.071	0.035	0.106			39.587	409.360
10. Glendale Ave. to HWY 405	1.3	0.93	1.21	Special Waste	13100	0.071	0.017	0.007	0.024	12	11	2.878	2.638
				Additives &Reagents	2634	0.014	0.003	0.001	0.005			0.058	0.053
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	15734	0.085	0.020	0.008	0.029			2.936	2.691
11. HWY 405 to RR. 101	2.6	0.99	2.57	Special Waste	13100	0.151	0.034	0.015	0.049	23	31	11.239	15.148
				Additives &Reagents	2634	0.030	0.007	0.003	0.010			0.226	0.305
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	15734	0.181	0.041	0.018	0.059			11.465	15.452
12. RR. 101 to RR. 57	2.4	0.82	1.97	Special Waste	13100	0.115	0.031	0.011	0.043	546	1686	233.463	720.913
				Additives &Reagents	2634	0.023	0.006	0.002	0.009			4.694	14.495
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	15734	0.139	0.038	0.014	0.051			238.157	735.409
13. RR. 57 to HWY 420	1.9	0.52	0.99	Special Waste	13100	0.058	0.025	0.006	0.031	333	1157	101.806	353.723
				Additives &Reagents	2634	0.012	0.005	0.001	0.006			2.047	7.112
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	15734	0.070	0.030	0.007	0.037			103.853	360.835

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SCENARIO 2, TOTAL SOLIDIFICATION

TABLE A-2: LOCAL AND REGIONAL ACCESS ROAD RISK LINK DATA FOR NUMBER OF RESIDENTS - PI-27E/LF-1E CASE 2 (1)

LINK DESCRIPTION	LENGTH (km)	ALL VEHICLE 1980-1982 ACC./MVkm	ALL VEHICLE ACCIDENTS PER M.V.	MATERIAL	OWMC ANNUAL ONE-WAY VEHICLE MOVEMENTS (2)	TWO-WAY OWMC ANNUAL ACCIDENT INVOLVMENT (3)	ANNUAL NUMBER OF SPILLS NON ACCIDENT RELATED (4)	ANNUAL NUMBER OF SPILLS ACCIDENT RELATED (5)	ANNUAL NUMBER OF SPILLS TOTAL	NO. OF RESIDENTS 0 - 150 (m)	NO. OF RESIDENTS 150 - 300 (m)	RECEPTOR INDEX: RESIDENTS 0 - 150 (m) (6,7,8)	RECEPTOR INDEX: RESIDENTS 150 - 300 (m) (6,7,8)
14. HWY 420 to RR. 49	3.1	0.57	1.77	Special Waste	13100	0.104	0.041	0.010	0.051	342	1780	173.643	903.755
				Additives &Reagents	2634	0.021	0.008	0.002	0.010			3.491	18.172
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	15734	0.125	0.049	0.012	0.061			177.134	921.927
15. RR. 49 to RR. 47	4.5	0.42	1.89	Special Waste	19552	0.166	0.088	0.016	0.104	101	112	105.250	116.713
				Additives &Reagents	2634	0.022	0.012	0.002	0.014			1.418	1.572
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	22186	0.188	0.100	0.018	0.118			106.668	118.285

SUMMARY TABLE	LENGTH (km)		ACCIDENTS PER MV.	MATERIAL	OWMC ANNUAL ONE-WAY VEHICLE REQUIREMENTS	TWO-WAY OWMC ANNUAL ACCIDENT INVOLVMENT (3)	ANNUAL NUMBER OF SPILLS NON ACCIDENT RELATED (4)	ANNUAL NUMBER OF SPILLS ACCIDENT RELATED (5)	ANNUAL NUMBER OF SPILLS TOTAL		RECEPTOR INDEX: RESIDENTS 0 - 150 (m)	RECEPTOR INDEX: RESIDENTS 150 - 300 (m)
ACCESS ROUTE TOTALS FOR SITE OPTION PI-27E/LF-1E CASE 2	39.0		35.63	Special Wastes	19552	1.964	0.512	0.192	0.705	TOTAL	1408.286	4746.106
				Additives & Reagents	2634	0.372	0.096	0.037	0.132	CORRIDOR WEIGHT	10.000	1.000
				Inter-Site Transfers	14274	0.260	0.039	0.025	0.064	CORRIDOR WEIGHTED		
				TOTAL	36460	2.596	0.646	0.254	0.901	TOTAL	14082.863	4746.106

: SUM OF WEIGHTED TOTALS 18828.968

Notes: 1. Based upon the receipt of 300,000 t/a of special waste and includes the process reagents and additives required to treat this quantity.
2. Based upon the revised total solidification treatment process defined by Monenco Limited, Febuary/March 1985.
3. Derived from all vehicle accident rate using a factor of 2.24.
4. Based on one spill per MVkm..
5. Derived using a conditional probability of 0.196, applied to one-way OWMC annual accident involvment.
6. The Hazard Indicies for the transported materials are, 10 for Special Waste and 1 for Inter-site Transfers and Additives & Reagents.
7. Receptor Indices are the product of "Total Number of Spills", the "Number of Residents" and the "Hazard Index".
8. The "Receptor Indices" and Link Totals have been rounded for display.

OWMC PHASE 4A - TRANSPORTATION

SCENARIO 2, TOTAL SOLIDIFICATION

TABLE A-3: LOCAL AND REGIONAL ACCESS ROAD RISK LINK DATA FOR COMMUNITY & RECREATIONAL FEATURES - PI-27E/LF-1E CASE 2 (1)

LINK DESCRIPTION	LENGTH (km)	ALL VEHICLE 1980-1982 ACC./MVkm	ALL VEHICLE ACCIDENTS PER M.V.	MATERIAL	OWMC ANNUAL ONE-WAY VEHICLE MOVEMENTS (2)	TWO-WAY OWMC ANNUAL ACCIDENT INVOLVMENT (3)	ANNUAL NUMBER OF SPILLS: NON ACCIDENT RELATED (4)	ANNUAL NUMBER OF SPILLS: ACCIDENT RELATED (5)	ANNUAL NUMBER OF SPILLS: TOTAL	COMM. & REC. FEATURES 0 - 150 (m) (9)	COMM. & REC. FEATURES 150 - 500 (m) (9)	RECEPTOR INDEX: COMM. & REC. FEATURES 0 - 150 (m) (6,7,8)	RECEPTOR INDEX: COMM. & REC. FEATURES 150 - 500 (m) (6,7,8)
A. REGIONAL ROAD 47 (BIGGAR ROAD /LYON'S CREEK ROAD)													
1. GEN to RR. 98	0.4	2.3	0.92	Special Wastes	19552	0.081	0.008	0.008	0.016	0	0	0.000	0.000
				Additives & Reagents	2634	0.011	0.001	0.001	0.002			0.000	0.000
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	22186	0.091	0.009	0.009	0.018			0.000	0.000
2. RR. 98 to PI-27E	0.8	1.3	1.04	Special Wastes	19552	0.091	0.016	0.009	0.025	0	0	0.000	0.000
				Additives & Reagents	2634	0.012	0.002	0.001	0.003			0.000	0.000
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	22186	0.103	0.018	0.010	0.028			0.000	0.000
3. PI-27E to Crowland Rd.	0.9	1.3	1.17	Special Wastes	0	0.000	0.000	0.000	0.000	0	0	0.000	0.000
				Additives & Reagents	0	0.000	0.000	0.000	0.000			0.000	0.000
				Inter-Site Transfers	14274	0.075	0.013	0.007	0.020			0.000	0.000
				TOTAL	14274	0.075	0.013	0.007	0.020			0.000	0.000
B. CROWLAND ROAD (LOCAL)													
1. RR. 47 to Carl Rd.	1	1.61	1.61	Special Wastes	0	0.000	0.000	0.000	0.000	0	0	0.000	0.000
				Additives & Reagents	0	0.000	0.000	0.000	0.000			0.000	0.000
				Inter-Site Transfers	14274	0.103	0.014	0.010	0.024			0.000	0.000
				TOTAL	14274	0.103	0.014	0.010	0.024			0.000	0.000
C. CARL ROAD (LOCAL)													
1. Crowland Rd. to Morris Rd.	0.8	1.61	1.29	Special Wastes	0	0.000	0.000	0.000	0.000	0	0	0.000	0.000
				Additives & Reagents	0	0.000	0.000	0.000	0.000			0.000	0.000
				Inter-Site Transfers	14274	0.082	0.011	0.008	0.019			0.000	0.000
				TOTAL	14274	0.082	0.011	0.008	0.019			0.000	0.000
D. Q.E.W.													
1. RR. 24 to RR. 26	2.7	0.92	2.48	Special Waste	13100	0.146	0.035	0.014	0.050	0	0	0.000	0.000
				Additives &Reagents	2634	0.029	0.007	0.003	0.010			0.000	0.000
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	15734	0.175	0.042	0.017	0.060			0.000	0.000
2. RR. 26 to RR. 34	4.4	0.88	3.87	Special Waste	13100	0.227	0.058	0.022	0.080	0	1	0.000	0.799
				Additives &Reagents	2634	0.046	0.012	0.004	0.016			0.000	0.016
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	15734	0.273	0.069	0.027	0.096			0.000	0.815
3. RR.34 to HWY 406	1.7	1.27	2.16	Special Waste	13100	0.127	0.022	0.012	0.035	0	0	0.000	0.000
				Additives &Reagents	2634	0.025	0.004	0.002	0.007			0.000	0.000
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	15734	0.152	0.027	0.015	0.042			0.000	0.000
4. HWY 406 to RR. 38	1	1.29	1.29	Special Waste	13100	0.076	0.013	0.007	0.021	0	0	0.000	0.000
				Additives &Reagents	2634	0.015	0.003	0.001	0.004			0.000	0.000
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	15734	0.091	0.016	0.009	0.025			0.000	0.000
5. RR. 38 to Ontario St.	0.8	0.89	0.71	Special Waste	13100	0.042	0.010	0.004	0.015	0	0	0.000	0.000
				Additives &Reagents	2634	0.008	0.002	0.001	0.003			0.000	0.000
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	15734	0.050	0.013	0.005	0.018			0.000	0.000

OWMC PHASE 4A - TRANSPORTATION

SCENARIO 2, TOTAL SOLIDIFICATION

TABLE A-3: LOCAL AND REGIONAL ACCESS ROAD RISK LINK DATA FOR COMMUNITY & RECREATIONAL FEATURES - PI-27E/LF-1E CASE 2 (1)

LINK DESCRIPTION	LENGTH (km)	ALL VEHICLE		MATERIAL	OWMC ANNUAL ONE-WAY VEHICLE MOVEMENTS (2)	TWO-WAY OWMC ANNUAL ACCIDENT INVOLVMENT (3)	ANNUAL NUMBER OF SPILLS			COMM. & REC. FEATURES		RECEPTOR INDEX: COMM. & REC. FEATURES	
		1980-1982 ACC./MVkm	ACCIDENTS PER M.V.				NON ACCIDENT RELATED (4)	ACCIDENT RELATED (5)	TOTAL	0 - 150 (m) (9)	150 - 500 (m) (9)	0 - 150 (m) (6,7,8)	150 - 500 (m) (6,7,8)
6. Ontario St. to Lake St.	1.2	0.67	0.80	Special Waste	13100	0.047	0.016	0.005	0.020	1	1	0.203	0.203
				Additives &Reagents	2634	0.009	0.003	0.001	0.004			0.004	0.004
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	15734	0.057	0.019	0.006	0.024			0.208	0.208
7. Lake St. to Niagara St.	1.7	0.96	1.63	Special Waste	13100	0.096	0.022	0.009	0.032	1	5	0.317	1.583
				Additives &Reagents	2634	0.019	0.004	0.002	0.006			0.006	0.032
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	15734	0.115	0.027	0.011	0.038			0.323	1.615
8. Niagara St. to Service Rd.	1.3	0.90	1.17	Special Waste	13100	0.069	0.017	0.007	0.024	0	2	0.000	0.475
				Additives &Reagents	2634	0.014	0.003	0.001	0.005			0.000	0.010
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	15734	0.082	0.020	0.008	0.029			0.000	0.485
9. Service Rd. to Glendale Ave	4.5	1.13	5.09	Special Waste	13100	0.298	0.059	0.029	0.088	0	0	0.000	0.000
				Additives &Reagents	2634	0.060	0.012	0.006	0.018			0.000	0.000
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	15734	0.358	0.071	0.035	0.106			0.000	0.000
10. Glendale Ave. to HWY 405	1.3	0.93	1.21	Special Waste	13100	0.071	0.017	0.007	0.024	0	0	0.000	0.000
				Additives &Reagents	2634	0.014	0.003	0.001	0.005			0.000	0.000
				Inter-Site-Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	15734	0.085	0.020	0.008	0.029			0.000	0.000
11. HWY 405 to RR. 101	2.6	0.99	2.57	Special Waste	13100	0.151	0.034	0.015	0.049	0	0	0.000	0.000
				Additives &Reagents	2634	0.030	0.007	0.003	0.010			0.000	0.000
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	15734	0.181	0.041	0.018	0.059			0.000	0.000
12. RR. 101 to RR. 57	2.4	0.82	1.97	Special Waste	13100	0.115	0.031	0.011	0.043	0	0	0.000	0.000
				Additives &Reagents	2634	0.023	0.006	0.002	0.009			0.000	0.000
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	15734	0.139	0.038	0.014	0.051			0.000	0.000
13. RR. 57 to HWY 420	1.9	0.52	0.99	Special Waste	13100	0.058	0.025	0.006	0.031	0	0	0.000	0.000
				Additives &Reagents	2634	0.012	0.005	0.001	0.006			0.000	0.000
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	15734	0.070	0.030	0.007	0.037			0.000	0.000
14. HWY 420 to RR. 49	3.1	0.57	1.77	Special Waste	13100	0.104	0.041	0.010	0.051	2	1	1.015	0.508
				Additives &Reagents	2634	0.021	0.008	0.002	0.010			0.020	0.010
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	15734	0.125	0.049	0.012	0.061			1.036	0.518

OWMC PHASE 4A - TRANSPORTATION

SCENARIO 2, TOTAL SOLIDIFICATION

TABLE A-3: LOCAL AND REGIONAL ACCESS ROAD RISK LINK DATA FOR COMMUNITY & RECREATIONAL FEATURES - PI-27E/LF-1E CASE 2 (1)

LINK DESCRIPTION	LENGTH (km)	ALL VEHICLE 1980-1982 ACC./MVkm	ALL VEHICLE ACCIDENTS PER M.V.	MATERIAL	OWMC ANNUAL ONE-WAY VEHICLE MOVEMENTS (2)	TWO-WAY OWMC ANNUAL ACCIDENT INVOLVMENT (3)	ANNUAL NUMBER OF SPILLS NON ACCIDENT RELATED (4)	ANNUAL NUMBER OF SPILLS ACCIDENT RELATED (5)	TOTAL	COMM. & REC. FEATURES 0 - 150 (m) (9)	COMM. & REC. FEATURES 150 - 500 (m) (9)	RECEPTOR INDEI: COMM. & REC. FEATURES 0 - 150 (m) (6,7,8)	RECEPTOR INDEI: COMM. & REC. FEATURES 150 - 500 (m) (6,7,8)
15. RR. 49 to RR. 47	4.5	0.42	1.89	Special Waste	19552	0.166	0.088	0.016	0.104	0	0	0.000	0.000
				Additives &Reagents	2634	0.022	0.012	0.002	0.014			0.000	0.000
				Inter-Site Transfers	0	0.000	0.000	0.000	0.000			0.000	0.000
				TOTAL	22186	0.188	0.100	0.018	0.118			0.000	0.000

SUMMARY TABLE	LENGTH (km)		ACCIDENTS PER MV.	MATERIAL	OWMC ANNUAL ONE-WAY VEHICLE REQUIREMENTS	TWO-WAY OWMC ANNUAL ACCIDENT INVOLVMENT (3)	ANNUAL NUMBER OF SPILLS NON ACCIDENT RELATED (4)	ANNUAL NUMBER OF SPILLS ACCIDENT RELATED (5)	TOTAL		RECEPTOR INDEI: RESIDENCES 0 - 150 (m)	RECEPTOR INDEI: RESIDENCES 150 - 500 (m)
ACCESS ROUTE TOTALS FOR SITE OPTION PI-27E/LF-1E CASE 2	39.0		35.63	Special Wastes	19552	1.964	0.512	0.192	0.705	TOTAL	1.566	3.640
				Additives & Reagents	2634	0.372	0.096	0.037	0.132	CORRIDOR WEIGHT	10.000	1.000
				Inter-Site Transfers	14274	0.260	0.039	0.025	0.064	CORRIDOR WEIGHTED		
				TOTAL	36460	2.596	0.646	0.254	0.901	TOTAL	15.663	3.640
										SUM OF WEIGHTED TOTALS		19.303

Notes: 1. Based upon the receipt of 300,000 t/a of special waste and includes the process reagents and additives required to treat this quantity.

2. Based upon the revised total solidification treatment process defined by Monenco Limited, Febuary/March 1985.

3. Derived from all vehicle accident rate using a factor of 2.24.

4. Based on one spill per MVkm..

5. Derived using a conditional probability of 0.196, applied to one-way OWMC annual accident involvment.

6. The Hazard Indicies for the transported materials are, 10 for Special Waste and 1 for Inter-site Transfers and Additives & Reagents.

7. Receptor Indices are the product of "Total Number of Spills", the "Number of Community & Recreational Features" and the "Hazard Index".

8. The "Receptor Indices" and Link Totals have been rounded for display.

9. Sensitive community and recreational features include; elementary schools, hospitals, nursing homes, homes for the aged, day care centers and children campgrounds.

APPENDIX I

(APPENDIX TO CHAPTER 8)

APPENDIX I

INTRODUCTION

Appendix I consists of the following tables:

Table I.1	Background and Rationale for Consideration - Facility Characteristics
Table I.2	Background and Rationale for Consideration - Risks
Table I.3	Background and Rationale for Consideration - Impacts
Table I.4	Background and Rationale for Consideration - Future Conditions and Study Area Boundaries
Table I.5	Background and Rationale for Consideration - Risks, Impacts and Costs
Table I.6	Method of Application
Table I.7	Sensitivity Analyses Included
Table I.8	Qualitative Sensitivity Analyses - Facility Characteristics
Table I.9	Qualitative Sensitivity Analyses - Risk Prediction
Table I.10	Qualitative Sensitivity Analyses - Impact Prediction
Table I.11	Qualitative Sensitivity Analyses - Future Conditions and Study Area Boundaries
Table I.12	Summary Results of Quantitative Sensitivity Analyses - Risks
Table I.13	Summary Results of Quantitative Sensitivity Analyses - Impacts
Table I.14	Summary Results of Quantitative Sensitivity Analyses - Future Conditions, Study Area Boundaries and Risks/Impacts/Costs

Tables I.1 to I.5 list the possible sensitivity analyses considered, the base case assumptions employed in the detailed comparative evaluation, the nature of the change that would occur under the sensitivity analyses and the rationale regarding why the sensitivity analysis was identified for consideration. These possible sensitivity analyses are grouped according to facility characteristics, risks, impacts, future conditions and study area boundaries and risks, impacts and costs.

Table I.6 provides the method of application, together with a supporting rationale, for each sensitivity analyses undertaken.

Table I.7 provides the arguments for and against the inclusion of sensitivity analyses not screened.

The results of the qualitative sensitivity analyses are presented in Tables I.8 to I.11. The factor scores for each of the quantitative sensitivity analyses are provided in Tables I.12, I.13 and I.14.

TABLE I.1

Background and Rationale for Consideration - Facility Characteristics

POSSIBLE SENSITIVITY ANALYSIS	BASE CASE ASSUMPTIONS	NATURE OF CHANGE	RATIONALE FOR CONSIDERATION
Facility Characteristics			
° haul methods - additives and reagents (road vs. road and rail)	° assumed that all special wastes and additives and reagents arrive by road	° assumes that additives and reagents transported by rail ° reduces truck movements and associated accidents and spill involvements	° OWMC may decide to consider rail for the transport of additives and reagents in the future; would reduce transportation risks and impacts on access routes but would involve added risks and impacts along rail access
° waste quantities (150,000 t/a vs. 300,000 t/a)	° risks and impacts predicted assuming 300,000 tonnes/annum ° facility expected to process 300,000 tonnes/annum by year 10 ° facility design based on initial treatment capacity of 150,000 t/a of incoming waste with provision for future expansion to 300,000 t/a	° sensitivity analysis to determine if ranking of siting options changes with assumption of 150,000 t/a	° possible that facility may not operate at greater than 150,000 t/a ° for positive economic base and municipal finance impacts 150,000 t/a represents the worst case

TABLE I.1

Background and Rationale for Consideration - Facility Characteristics

POSSIBLE SENSITIVITY ANALYSIS	BASE CASE ASSUMPTIONS	NATURE OF CHANGE	RATIONALE FOR CONSIDERATION
Facility Characteristics (cont'd)			
° waste quantities (150,000 t/a vs. 300,000 t/a) (cont'd)	° use of 300,000 t/a ensures (in most cases) that risks and impacts are not underestimated		
° waste sources (scenario 1 vs. scenario 2)	° scenario 2 - assumes that the amount of waste attracted to the OWMC facility is sensitive to the travel distance between waste sources and the treatment site	° scenario 1 - assumes province-wide distribution of waste sources and all areas of Province contribute to the waste stream - not sensitive to travel distance	° scenarios represent two extremes: actual waste distribution pattern will not be known until facility has been operating for years; will be somewhere between extremes ° distribution of wastes influences transportation risks, impacts and costs
° technology (partial vs. total solidification)	° assumes all waste residues and liquid effluents are solidified and deposited in a landfill (total solidification)	° after study completed by M.M. Dillon Ltd. (Appendix G) which ranked liquid effluent disposal options - OWMC decided that on-site liquid effluent disposal -	° option under consideration by OWMC ° with evaporation: - reduced truck movements - reduced transportation risks and impacts

TABLE I.1

Background and Rationale for Consideration - Facility Characteristics

POSSIBLE SENSITIVITY ANALYSIS	BASE CASE ASSUMPTIONS	NATURE OF CHANGE	RATIONALE FOR CONSIDERATION
Facility Characteristics (cont'd)			
° technology (partial vs. total solidification) (cont'd)		preferred of partial solidification options ° with evaporation - treated effluent is evaporated and discharged to atmosphere; residues solidified and deposited in landfill ° sensitivity analysis to determine if ranking of siting options changes with assumption of evaporation	- additional 45 m stack required and auxiliary boilers - possibility of off-site fogging - visible steam plume (length dependent on meteorological conditions)
° stack height (60 m vs. 100 m)	° stack height: - maximum 100 m - minimum 60 m ° assumption varied with discipline - whichever represented the worst case	° alternative assumption in each case - 60 m vs. 100 m	° finalization of stack height not expected to occur until Phase 4B ° choice of stack height affects visual impacts and air quality/ air dispersion analyses/ municipal financial analyses

TABLE I.1

Background and Rationale for Consideration - Facility Characteristics

POSSIBLE SENSITIVITY ANALYSIS	BASE CASE ASSUMPTIONS	NATURE OF CHANGE	RATIONALE FOR CONSIDERATION
Facility Characteristics (cont'd)			
° landfill type (conventional vs. shallow entombment)	° assumes conventional (standard) landfill - waste residues placed in a relatively shallow excavation and mounded above ground	° entombed landfill - treated waste residues placed in a deep excavation so that the top of the landfill is below the weathered (fractured) surface zone	° both landfill types still under consideration by OWMC ° differences between landfill types in hydrogeologic risks; other risks and impacts not considered as data not available in Phase 4A

TABLE I.2

Background and Rationale for Consideration - Risks

POSSIBLE SENSITIVITY ANALYSIS	BASE CASE ASSUMPTIONS	NATURE OF CHANGE	RATIONALE FOR CONSIDERATION
Risk Prediction			
° indirect air risks	° in Phase 4A risks from ingestion of cistern and pond water and from consumption of crops and livestock considered ° although level of risks very low, even with very conservative assumptions, (10^{-7} or less) indirect still considered relevant to comparative evaluation	° assumption that level of risks so low in absolute sense, even with conservative assumptions that not relevant to comparative evaluation	° possible to argue that chronic indirect air risks are so low that comparative evaluation choices should be on the basis of other risk and impact considerations
° chronic air risks	° in Phase 4A risks from direct inhalation of emissions - chronic considered ° although level of risks very low, even with very conservative assumptions (10^{-6} or less) still considered relevant to comparative evaluation	° as above	° as above

TABLE I.2

Background and Rationale for Consideration - Risks

POSSIBLE SENSITIVITY ANALYSIS	BASE CASE ASSUMPTIONS	NATURE OF CHANGE	RATIONALE FOR CONSIDERATION
Risk Prediction (cont'd)			
° susceptibility of site to flooding	° assumption that of difference in susceptibility of sites to flooding reflected in factor suitability level differences	° assumption that LF-3C only site where flooding susceptibility a concern; LF-3C was of concern re flooding due to proximity of nearby flood-plain lands; the sites have local flooding potential due to flat topography, inefficient drainage systems and undersized conveyance features. The latter can be overcome through design while the former essentially requires the avoidance of floodplain land; adjustments in factor suitability levels and factor rankings to emphasize differences	° analysis of flood susceptibility indicates that flooding differences not considered significant for any option, with the exception of LF-3C; however, only two level difference in factor suitability levels

TABLE I.2

Background and Rationale for Consideration - Risks

POSSIBLE SENSITIVITY ANALYSIS	BASE CASE ASSUMPTIONS	NATURE OF CHANGE	RATIONALE FOR CONSIDERATION
Risk Prediction (cont'd)			
° alternative dispersion climatologies	° mathematical dispersion modelling depends on assumed dispersion climatologies derived from long-term statistical data on wind and atmospheric stability conditions; data based on observations made at Toronto's Pearson International Airport (for sites north of Lake Ontario) and Mount Hope and St. Catharines Airports (for sites south of Lake Ontario)	° two sensitivity analyses undertaken by air quality consultant to address possible wind channelling through gap in the Niagara Escarpment between Rattlesnake Point and Mount Nemo ° one sensitivity analysis undertaken to represent the effects of more intense atmospheric turbulence due to proximity to the escarpment ° additional sensitivity analysis undertaken to assess effects of possible errors in assumed wind frequencies at all sites	° addresses areas of uncertainty regarding data base ° undertaken by air dispersion/ air quality consultant

TABLE I.2

Background and Rationale for Consideration - Risks

POSSIBLE SENSITIVITY ANALYSIS	BASE CASE ASSUMPTIONS	NATURE OF CHANGE	RATIONALE FOR CONSIDERATION
Risk Weights			
° direct and indirect chronic air	° assumption that difference in importance between direct and indirect air factors reflected in factor ranking level differences	° adjustments in factor weights to reflect order of magnitude differences in severity of risks and mitigation potential with indirect air pathways	° factor weights adjustments more accurately reflect inputs to factor rankings, i.e. severity of risk, mitigation potential
° local and regional and province-wide access routes	° assumption that local and regional access routes more important than province-wide access routes	° adjust factor weights to make province-wide access routes as important and more important than local and regional access routes	° as described in Chapter 4 (Volume 2) possible to make a case favouring greater, lesser or same weight for province-wide access routes as compared with local and regional access routes
° transportation (less weight)	° assumption that natural containment and transportation (local and regional access routes) equally important	° reduce factor weight for local and regional access routes	° possible to argue that more limited differences across siting options for transportation (spills posing risks to human health and fatal or personal injury

TABLE I.2

Background and Rationale for Consideration - Risks

POSSIBLE SENSITIVITY ANALYSIS	BASE CASE ASSUMPTIONS	NATURE OF CHANGE	RATIONALE FOR CONSIDERATION
Risk Weights (cont'd)			
° transportation (less weight) (cont'd)			accidents) than is the case for natural containment (substantial differences in natural containment abilities of options as reflected in breakthrough times)
° transportation (greater weight)	° assumption that transportation (local and regional access routes) highest ranked factors, together with natural containment	° increase weight of transportation risk until LF-4N/PI-1N is the preferred siting option	° has been argued that transportation risk should supercede other risk and impact considerations; major advantage of Milton siting option (LF-4N/PI-1N) - clearly lower transportation risk than other siting options; sensitivity analysis tests how much additional weight must be placed on transportation risk for LF-4N/PI-1N to

TABLE I.2

Background and Rationale for Consideration - Risks

POSSIBLE SENSITIVITY ANALYSIS	BASE CASE ASSUMPTIONS	NATURE OF CHANGE	RATIONALE FOR CONSIDERATION
Risk Weights (cont'd) ° transportation (greater weight) (cont'd)			be favoured and whether such a change is warranted ° transportation most highly ranked factor by public at OWMC workshop
Risk Mitigation			
° susceptibility of site to flooding	° low factor ranking (level 3) based on mitigation potential	° assume constraint fully mitigable - delete factor	° could be argued that if constraint mitigable, then should not be included in comparative evaluation ° surface water use factor maintained because of ground/ surface water connection
° ground and surface water use and flooding	° moderate factor rankings (level 7) based on mitigation potential	° assume constraints fully mitigable - delete factors ground and surface water use and flooding	° could be argued that if surface water release fully mitigable and ground water release addressed by natural containment factors, then inclusion of water use and flooding factors not necessary for comparative evaluation

TABLE I.2

Background and Rationale for Consideration - Risks

POSSIBLE SENSITIVITY ANALYSIS	BASE CASE ASSUMPTIONS	NATURE OF CHANGE	RATIONALE FOR CONSIDERATION
Risk Mitigation (cont'd)			
° acute air risks	° although mitigation potential recognized, mitigation not assumed; high factor rank - level 8	° assume fully mitigable - delete factor	° based on events reviewed to date, mitigation appears possible; if more detailed analysis of events reveals that all acute risks mitigable - question of implications for siting option rankings
° emergency back-up	° assumed that OWMC will provide adequate emergency response capability irrespective of where facility is located ° assumption of Phase 4A that emergency response capability is equal (or will be made equal) for all siting options	° assume that some degree of back-up emergency facility will be provided by municipalities	° municipalities vary in the type of emergency response facilities and services which they possess, e.g. fire, police, hospitals ° services and facilities do vary in proximity and degree of sophistication ° some services, e.g. police, hospital, cannot be provided on site

TABLE I.3

Background and Rationale for Consideration - Impacts

POSSIBLE SENSITIVITY ANALYSIS	BASE CASE ASSUMPTIONS	NATURE OF CHANGE	RATIONALE FOR CONSIDERATION
Impact Prediction			
° ability of community to cope with change	° the land use, social and agricultural disciplines equated ability to cope with OWMC change with measures of experience with change in the past ° with municipal services and finance, average costs for municipal services applied to municipal operating cost impacts; concerns of municipalities regarding incremental cost changes noted	° assumption that qualitative difference in ability to cope with OWMC-related changes as compared with changes experienced in past ° assumption that experience with industrial-type uses and major urban development, as compared with land ownership turnover and urban fringe development qualitatively different ° assumption that incremental costs more of a concern in municipalities with a limited range of services and limited experience in managing growth ° assumption that municipal services impacts not always	° reflects unique nature of OWMC facility ° reflects qualitative differences in communities and potential impacts not likely to be fully captured with measures of past changes and costs ° area of uncertainty subject to conflicting interpretations, e.g. nature and magnitude of change (in-migration, out-migration, service demands) and reaction of community to change ° community concern

TABLE I.3

Background and Rationale for Consideration - Impacts

POSSIBLE SENSITIVITY ANALYSIS	BASE CASE ASSUMPTIONS	NATURE OF CHANGE	RATIONALE FOR CONSIDERATION
Impact Prediction (cont'd)			
° ability of the community to cope with change (cont'd)		reflected in municipal costs, e.g. increased workload	
° less conservative approach - noise impacts - access roads	° estimate represents number of residents affected by traffic-related sound levels of 55 dBA or greater in year 2000 with OWMC truck traffic	° determine difference in number of residents within the 55 dBA noise contour for the year 2000 with the OWMC traffic and the number of residents within the 55 dBA noise contour for the year 2000 without the OWMC traffic	° excludes residents who may be affected by traffic-related sound levels of 55 dBA and over in the future, even if the OWMC trucks are not added
° industrial attraction differences	° assumed that no spin-off industries will locate near the siting options due to the availability of OWMC facilities, waste products or services	° assumption that spin-off industry generates regional employment of 200 jobs; corresponding increase in household growth	° some uncertainty in predictions of industrial spin-off impacts ° analysis undertaken by Economic Base consultant
° if PI-1N selected by Region of Halton	° assumed that PI-1N will not be selected by the Region of	° assumption that PI-1N will be selected by the Region of Halton	° Region of Halton may yet select PI-1N as its preferred site

TABLE I.3

Background and Rationale for Consideration - Impacts

POSSIBLE SENSITIVITY ANALYSIS	BASE CASE ASSUMPTIONS	NATURE OF CHANGE	RATIONALE FOR CONSIDERATION
Impact Prediction (cont'd)			
° if PI-1N selected by Region of Halton	Halton for its regional landfill	for its regional landfill	° municipal services and finance differences if PI-1N selected by Region of Halton ° undertaken by Municipal Finance consultant
° soil capability class revisions	° soil capability ratings for sites provided by the Ontario Institute of Pedology (O.I.P.)	° revised soil capability ratings subsequently provided by O.I.P.	° desirable to review comparative evaluation based on latest available data ° undertaken by Agricultural consultant
° sensitive crop list	° assumptions made regarding which crops are potentially sensitive to airborne emissions	° assumption that all crops are potentially sensitive to airborne emissions	° recognizes that the information based on the scientific literature is limited
° larger negative property value and out-migration impacts	° assumes property values would decrease with distance up to 1500 metres ° no assumption made regarding out-migration	° property values change based on largest negative impacts encountered in literature search	° some uncertainty in predictions ° analysis undertaken by Economic Base consultant

TABLE I.3

Background and Rationale for Consideration - Impacts

POSSIBLE SENSITIVITY ANALYSIS	BASE CASE ASSUMPTIONS	NATURE OF CHANGE	RATIONALE FOR CONSIDERATION
Impact Prediction (cont'd)			
° larger negative property value and out-migration impacts (cont'd)		° assumed all households interviewed in the Walk and Talk program (by IER) who indicated that they would leave would actually do so	
Impact Weights			
° industrial designation (greater weight)	° planned and proposed land use - moderately ranked factors - reflects future land use uncertainty and mitigation potential ° with the exception of agriculture uses and features on industrially designated sites and in the vicinity of industrially designated sites, features treated the same by other disciplines irrespective of land use designation	° greater weight to planned and proposed land uses and less weight to site/site vicinity features and uses in or surrounding industrially designated sites	° importance attached to industrial designation has an important bearing on LF-9C vs. LF-1E/PI-27E comparison and on LF-1E/PI-27E vs. LF-1E comparison ° importance attach designation and to uses and features affected by designation subject to conflicting interpretations (see Chapters 5 and 6)

TABLE I.3

Background and Rationale for Consideration - Impacts

POSSIBLE SENSITIVITY ANALYSIS	BASE CASE ASSUMPTIONS	NATURE OF CHANGE	RATIONALE FOR CONSIDERATION
Impact Weights (cont'd)			
° industrial designation (deleted for PI-27E) (lower weight)	° land use and agriculture analyses assumes industrial designation for PI-27E	° removal of industrial designation for PI-27E	° Phase 4A analysis placed greater emphasis on industrial designation; addresses possibility of a change in designation
° greater weight - displacement of farmland and farms (on-site and partial)	° factor weight - loss of farmland (3 of 5); reflects small absolute land loss ° factor weight - (3 of 5) displacement of farms with on-site headquarters; reflects compensation available under standard processes	° increase weight of displacement of farmland and farms (on site and partial displacement)	° argument put forward by Ontario Ministry of Agriculture and Food - displacement of farms and farmland ° loss of unique resource ° conflict with provincial policy regarding foodlands
° less weight air impacts	° factor weight - restraints to dispersion - 2; existing and anticipated air quality - 6	° reduce weight of both factors	° air dispersion - minimal constraint based on dispersion analysis; mitigation not expected to be required ° existing and anticipated air quality - OWMC

TABLE I.3

Background and Rationale for Consideration - Impacts

POSSIBLE SENSITIVITY ANALYSIS	BASE CASE ASSUMPTIONS	NATURE OF CHANGE	RATIONALE FOR CONSIDERATION
Impact Weights (cont'd)			
° less weight air impacts			emissions very small proportion of applicable standards - 1% - 3%; major constrained areas avoided during previous stages
° greater weight - natural environmental factors - site and site vicinity	° factor weights: - rare species - site - 8 - natural vegetation displaced - site - 4 - potential for occurrence of other significant features - site - 6 - significant environmental units - site vicinity - 4 - fish and wildlife features of significance - site vicinity - 2 - other natural vegetation - site vicinity - 3 - rare species - site vicinity - 2	° revise all factor weights - upwards	° argument that larger number of socio-economic disciplines - tends to result in natural environmental concerns being outweighed in quantitative aggregation; by ranking natural environmental factors more highly, tends to offset

TABLE I.3

Background and Rationale for Consideration - Impacts

POSSIBLE SENSITIVITY ANALYSIS	BASE CASE ASSUMPTIONS	NATURE OF CHANGE	RATIONALE FOR CONSIDERATION
Impact Weights (cont'd)			
° business, agriculture, tourism components of economic base	° component weights: - economic base - 30 - agriculture - 15 - tourism - 9 ° economic differences by municipalities represented by separate set of weights	° increase weights of agriculture and tourism relative to economic base	° argument that, in terms of employment and income (direct and indirect), and broader role within provincial economy, agriculture and tourism as important as industry ° agency and community concern
° alternative positive and negative economic base factor weights	Base Case Scenario ° Displacement of Business Activity - 4 ° Property Value Impacts - 7 ° Business Activity Positively Affected by the Presence of OWMC Facilities - 4	Alternative Factor Ranking ° Displacement of Business Activity - 3 ° Property Value Impacts - 5 ° Business Activity Positively Affected by the Presence of OWMC Facilities - 6	° subject to alternative interpretation ° undertaken by Economic Base consultant
° reduced weights - community and regional and access road impacts	° ranking levels range from 1 to 9	° drop each community and regional and access road impact factor by one factor ranking	° moderate and, to some extent, indirect impacts ° undertaken by Agricultural consultant

TABLE I.3

Background and Rationale for Consideration - Impacts

POSSIBLE SENSITIVITY ANALYSIS	BASE CASE ASSUMPTIONS	NATURE OF CHANGE	RATIONALE FOR CONSIDERATION
Impact Weights (cont'd)			
° reduced weights - community and regional and access road impacts (cont'd)			° reflects public input at OWMC workshops ° subject to alternative interpretation
° alternative indicator and subindicator weights - economic base	° base case scenario range of weight between 2 and 5	° reduced indicator and subindicator weights for perceived impacts	° area of uncertainty - subject to alternative interpretation ° undertaken by Economic Base consultant
° alternative weights for disciplines	° no direct weighting of disciplines; factors ranked individually; disciplinary ranking the product	° alternative weight for disciplines	° possible to argue that disciplines should be ranked first and then factors within disciplines
Impacts - Mitigation and Compensation			
° assume municipal services and financial impacts mitigable through compensation	° OWMC would make payments-in-lieu of taxes to municipality chosen for OWMC facility ° OWMC would pay for any	° assumption that any other municipal service or financial impact occurs which would leave a municipality in	° possibility of unanticipated adverse financial impacts ° OWMC commitment that no municipality

TABLE I.3

Background and Rationale for Consideration - Impacts

POSSIBLE SENSITIVITY ANALYSIS	BASE CASE ASSUMPTIONS	NATURE OF CHANGE	RATIONALE FOR CONSIDERATION
Impacts - Mitigation and Compensation (cont'd)			
° assume municipal services and financial impacts mitigable through compensation (cont'd)	municipal capital works ° assessed values as estimated by Ministry of Revenue ° fire protection for OWMC facilities available on site ° local school capacities are sufficient to accommodate increases in enrolment as a result of OWMC facilities, to the extent that financial impact occurs almost entirely offset by the provincial education grant structure	a negative position financially would be offset by additional financial compensation from municipality ° assumption that once municipality in positive position financially, magnitude of benefits not directly relevant to siting option comparison	will suffer financially ° primary focus of site selection process to minimize risks and adverse impacts
° assume on-site impacts mitigable businesses, residents, farms, natural features, land uses	° assumes full mitigation - community and recreation features and archaeological resources ° assumes compensation	° assumes additional compensation measures for relocated uses, e.g. special relocation assistance more than market	° additional measures can be introduced on a use-by-use and feature-by-feature basis to greatly reduce and potentially fully

TABLE I.3

Background and Rationale for Consideration - Impacts

POSSIBLE SENSITIVITY ANALYSIS	BASE CASE ASSUMPTIONS	NATURE OF CHANGE	RATIONALE FOR CONSIDERATION
Impacts - Mitigation and Compensation (cont'd)			
° assume on-site impacts mitigable businesses, residents, farms, natural features, land uses (cont'd)	paid consistent with prevailing provincial practice ° assumes all on-site uses and features displaced (with the exception of previously noted portion of PI-27E) ° assumes some social, and to a lesser extent, economic impacts which would not be fully addressed by prevailing practices ° assumes no off-site natural environmental enhancement measures to offset on-site impacts ° assumes agricultural land - a permanent resource loss	value such that adverse impacts fully offset ° assumes on and off-site habitat enhancement measures taken to offset on-site natural environmental impacts ° no change in assumption regarding displacement of agricultural land	compensate/ mitigate adverse impacts

TABLE I.3

Background and Rationale for Consideration - Impacts

POSSIBLE SENSITIVITY ANALYSIS	BASE CASE ASSUMPTIONS	NATURE OF CHANGE	RATIONALE FOR CONSIDERATION
Impacts - Mitigation and Compensation (cont'd)			
° assume impacts on adjacent residents, community and recreation features, and farms mitigable through property buy-out program	° no compensation to adjacent residents assumed except as might occur through current practice, e.g. injurious affection	° assumption of voluntary purchase of adjacent residents and farms	° a policy option under consideration by OWMC a form of mitigation/ compensation for residents who are most directly affected over the long-term
° assume site vicinity noise impacts largely mitigable (design and operations changes)	° effort made to minimize noise through facility design and operations ° daytime (55 dBA) and nighttime (50 dBA) noise contours plotted and houses and community and recreation features within contours counted	° no change in daytime noise levels assumed ° a 5 dBA reduction in plant sound levels - nighttime assumed	° with landfill, because of range of sources, not possible to predict potential effectiveness of noise mitigation ° reduction in noise levels for plant, a decrease of 5 dBA considered technically and financially feasible ° as design progresses, an effort will be made to reduce noise and other effects further

TABLE I.3

Background and Rationale for Consideration - Impacts

POSSIBLE SENSITIVITY ANALYSIS	BASE CASE ASSUMPTIONS	NATURE OF CHANGE	RATIONALE FOR CONSIDERATION
Impacts - Mitigation and Compensation (cont'd)			
° assume property value impacts mitigable (property value protection program)	° no property value protection program	° assumption that property value protection program fully offsets negative property value impacts	° a policy option under consideration by OWMC ° if property value changes minor and short-term, program likely to be feasible
° assume natural environmental site vicinity impacts mitigable (design and operations, habitat creation and enhancement)	° assumes that all natural features within site vicinity adversely affected ° no attempt made to differentiate degrees of impact within the site vicinity	° assume that site vicinity natural environmental effects minor, and to the extent that they occur, mitigable	° based on facility characteristics data, expectation that natural environmental effects off-site will be limited ° highly significant and sensitive areas largely avoided as a result of past site selection decisions ° effects likely to occur appear mitigable
° assume entire site assessed as industrial land	° assumption made that only central operating area	° assume that entire site assessed as industrial land	° possible that the Ministry of Revenue would assess the land

TABLE I.3

Background and Rationale for Consideration - Impacts

POSSIBLE SENSITIVITY ANALYSIS	BASE CASE ASSUMPTIONS	NATURE OF CHANGE	RATIONALE FOR CONSIDERATION
Impacts - Mitigation and Compensation (cont'd)			
° assume entire site assessed as industrial land (cont'd)	would be assessed as industrial land for assessment purposes; assumed that buffer area (including landfill) would be classed as farmland for assessment land		outside the central operating area as unserviced industrial, rather than farmland
° no payments-in-lieu of business taxes	° assumes that OWMC will contribute payments-in-lieu of business taxes on 30% of the assessed value of its facilities	° no payments-in-lieu of business taxes	° possibility that OWMC may not make payments-in-lieu of business taxes

TABLE I.4

Background and Rationale for Consideration - Future Conditions and Study Area Boundaries

POSSIBLE SENSITIVITY ANALYSIS	BASE CASE ASSUMPTIONS	NATURE OF CHANGE	RATIONALE FOR CONSIDERATION
Future Conditions and Study Area Boundaries			
° future scenarios	° assumption of future conditions the same as existing conditions; except where predictions, e.g. traffic forecasts or policies for future, e.g. land use designations in place	° review of trends and expectations to determine likely future conditions (year 2001) without facility	° allows for change that might have occurred in any event without OWMC facility; without such a perspective, it is possible that potential impacts might have been over or underestimated
° construction impacts	° focus of analysis impacts during operations period ° expectation that construction labour will largely commute from urban municipalities and that there will be no construction camp ° assumption that site, site vicinity and access road impacts will be minor and, in part, mitigable	° more explicit consideration of construction impacts in a separate sensitivity analysis	° desirable to review impacts during different periods ° not all impacts mitigable ° construction impacts will extend over an 18-month period; not all impacts, e.g. truck traffic and noise, will be minor ° construction disruption may be more of a concern in some areas than in others

TABLE I.4

Background and Rationale for Consideration - Future Conditions and Study Area Boundaries

POSSIBLE SENSITIVITY ANALYSIS	BASE CASE ASSUMPTIONS	NATURE OF CHANGE	RATIONALE FOR CONSIDERATION
Future Conditions and Study Area Boundaries (cont'd)			
° construction impacts (cont'd)	° construction impacts generally built into existing Phase 4A factors and factor rankings		
° secondary access routes - West Lincoln	° assumption that all local and regional transportation movements would occur on preferred access routes in West Lincoln	° recognition that there will be, with the West Lincoln sites, a limited use of other access routes; consideration of differences	° approximately 19 trucks per day will approach sites LF-3C or LF-9C from the east and south of Hwy. 20/ R.R. 24 intersection and from the southwest of the West Lincoln area ° although OWMC can minimize use of secondary routes through, for example, agreements with haulers, OWMC cannot force adherence ° the potential use of secondary access routes varies somewhat

TABLE I.4

Background and Rationale for Consideration - Future Conditions and Study Area Boundaries

POSSIBLE SENSITIVITY ANALYSIS	BASE CASE ASSUMPTIONS	NATURE OF CHANGE	RATIONALE FOR CONSIDERATION
Future Conditions and Study Area Boundaries (cont'd)			
° secondary access routes - West Lincoln (cont'd)			among siting options ° concern raised by some communities
° definition of local and regional access roads - Niagara Falls	° assumption that local and regional access routes begin from exit from 400-series highways	° assumption that local and regional access routes for Niagara Falls siting options begin from exit point on 400-series highways for the West Lincoln siting options	° as detailed in Chapter 6, there are a number of arguments for redefining local and regional access routes; question of judgement ° analysis focuses on four top ranked options
° transportation (receptors)	° risk receptors counted on local and regional access routes, but not for province-wide access routes	° eliminate local and regional access road risk receptors; (including risks to surface water suitability due to spills and risk to sensitive hydrogeologic lands due to spills) comparison made on basis of potential spills and accidents	° could be argued that such an approach is more consistent than counting receptors for only a portion of access system

TABLE I.4

Background and Rationale for Consideration - Future Conditions and Study Area Boundaries

POSSIBLE SENSITIVITY ANALYSIS	BASE CASE ASSUMPTIONS	NATURE OF CHANGE	RATIONALE FOR CONSIDERATION
Future Conditions and Study Area Boundaries (cont'd)			
° definition of local and regional access roads - Milton	° assumption that local and regional access routes begin from exit from 400-series highways	° assumption that local and regional access route for West Lincoln and Niagara Falls siting options begins from exit point on 400-series highways for the Milton siting options	° as detailed in Chapter 6, there are a number of arguments for redefining local and regional access routes ° analysis addresses all as siting options ° transportation - a major advantage for Milton options
° site vicinity boundary - LF-1E	° site vicinity defined as 2 km from the centre of each candidate site ° some adjustments made in site vicinity boundaries at outset of Phase 4A to include major features and on the basis of land ownership patterns	° modification of site vicinity boundaries - LF-1E to take in major industries just beyond site vicinity boundaries	° has major influence on siting option ranking by Economic Base consultant ° recognition that any boundary is somewhat artificial

TABLE I.4

Background and Rationale for Consideration - Future Conditions and Study Area Boundaries

POSSIBLE SENSITIVITY ANALYSIS	BASE CASE ASSUMPTIONS	NATURE OF CHANGE	RATIONALE FOR CONSIDERATION
Future Conditions and Study Area Boundaries (cont'd)			
° site boundary - LF-3C	° assumption that whole site required for facility development	° limit site area to portion of site to the west of Krick Road	° possible that not all of site will be required; minimizes on-site natural environmental and agricultural impacts
° site boundary LF-1E (as part of integrated siting option)	° entire Phase 3B boundary used for integrated siting option	° consider site boundary LF-1E (as part of LF-1E/PI-27E) and the southwest lot 14-2-23 of LF-1E (integrated)	° potential to test effect of reducing area on landfill life and reduction of impacts and risks through smaller site area

TABLE I.5

Background and Rationale for Consideration - Risks, Impacts and Costs

POSSIBLE SENSITIVITY ANALYSIS	BASE CASE ASSUMPTIONS	NATURE OF CHANGE	RATIONALE FOR CONSIDERATION
Risks, Impacts and Costs			
° greater weight - risks	° equal weight - risks and impacts (with quantitative aggregation)	° progressively increase weight of risks until changes in siting option rankings	° OWMC policy - risks ranked more highly than impacts ° tests sensitivity of rankings to degrees of importance attached to risk
° risks, impacts and costs	° costs not included in quantitative aggregation; used as tempering considerations in qualitative aggregation (Chapters 5 and 6)	° include cost and engineering flexibility differences in quantitative aggregation	° minimizing costs is an OWMC goal ° an engineering flexibility difference could possibly offset a minor to moderate risk or impact difference
° cost - sensitivity analyses - cost estimates and discount rates	° cost sensitivity analyses adequately addressed in Phase 4A engineering report (Monenco, 1986)	° include cost sensitivity analyses	° affects magnitude of cost differences among siting options

TABLE I.5

Background and Rationale for Consideration - Risks, Impacts and Costs

POSSIBLE SENSITIVITY ANALYSIS	BASE CASE ASSUMPTIONS	NATURE OF CHANGE	RATIONALE FOR CONSIDERATION
Risks, Impacts and Costs (cont'd)			
° costs - transport loading and unloading times	° a series of assumptions were derived by the Transportation consultant regarding loading and unloading time for different vehicle times; data developed by Dillon and Pilorusso; primarily used as input to costing of transport haulage	° increase loading times	° affects transport haulage costs ° addressed by Transportation consultant

TABLE I.6

Method of Application

SENSITIVITY ANALYSIS	METHODS OF APPLICATION	RATIONALE
Facility Characteristics		
° haul methods (road vs. road and rail)	° qualitative - indicate general direction of change, general sense of magnitude and likely implications for siting option rankings	° based on data available possible to indicate direction of change of various risks and impacts, but not possible to predict magnitude of change
° waste quantities (150,000 t/a vs. 300,000 t/a)	° qualitative - as above	° as above
° waste sources - (Scenario 1 vs. Scenario 2)	° qualitative - as above	° as above
° technology (total vs. partial solidification)	° qualitative - as above	° as above
° stack height (60 m vs. 100 m)	° qualitative - as above	° as above
° landfill type (conventional vs. shallow entombment)	° qualitative indicate which options are suitable (hydrogeologically) for conventional only and which are suitable for conventional or shallow entombment	° no data available for future distinctions
Risk Prediction		
° indirect air risks	° quantitative - delete - indirect air risk factors: - risk from ingestion	° lower limit; below threshold of consideration

TABLE I.6

Method of Application

SENSITIVITY ANALYSIS	METHODS OF APPLICATION	RATIONALE
Risk Prediction (cont'd)		
° indirect air risks (cont'd)	of cistern and pond water - risk from consumption of crops and livestock	
° chronic air risks	° quantitative - delete - direct and indirect inhalation of emissions - chronic factors	° lower limit; below threshold of consideration
° susceptibility of site to flooding	a) quantitative - leave suitability level - flooding susceptibility - for LF-3C at 5; adjust factor suitability levels for all other siting options to 1 b) quantitative - as above but increase weight of factor to 7 (equal with water use factors)	° maximizes distinction between LF-3C and the remaining siting options in terms of flood susceptibility
Risk Weights		
° direct and indirect chronic air	a) quantitative - change factor weight for acute air risks from 8 to 9; same as direct inhalation of emissions - chronic b) change factor weight for acute air risks to 9 and change factor weight for chronic air risks from 9 to 8 c) qualitative - direct air risk factors	° as arguable as to which is more important, chronic versus acute air risks addresses: - assumption of same weight - assumption of greater weight to acute risks ° greater weight to chronic risks already addressed ° no basis for further

TABLE I.6

Method of Application

SENSITIVITY ANALYSIS	METHODS OF APPLICATION	RATIONALE
Risk Weights (cont'd)		
° direct and indirect chronic air (cont'd)	weighted higher than indirect air factors	adjustments
° local and regional and province-wide access routes	° quantitative - change factor weight - province-wide access routes from level 8 to 10	° as arguable as to which is more important - local and regional transportation risk versus province-wide risks addressed: - assumption of same weight for province-wide access routes - assumption of greater weight for province-wide access routes ° no basis for further adjustment
° transportation (less weight)	° quantitative - change factor weight for transportation - local and regional access routes from 10 to 8	° reflects relatively narrow range of differences across siting options ° in view of severity, frequency and mitigation potential differences - no basis for further reductions re. weights for transportation risk factors
° transportation (greater weight)	° quantitative - progressively increase weight transportation risks until LF-4N/PI-1N is the preferred siting option	° indicates how much additional weight would need to be placed on transportation risk for most favoured option (LF-4N/PI-1N), from a

TABLE I.6

Method of Application

SENSITIVITY ANALYSIS	METHODS OF APPLICATION	RATIONALE
Risk Weights (cont'd)		
° transportation (greater weight) (cont'd)		transportation risk perspective, to be the most favoured option overall
Risk Mitigation		
° susceptibility of site to flooding	° quantitative - delete susceptibility of site to flooding factor	° upper limit of mitigation potential
° ground and surface water use	° quantitative - delete ground and surface water use and susceptibility to flooding factors	° upper limit of mitigation potential
° acute air risks	° quantitative - delete - risk from direct inhalation of emissions - acute	° upper limit of mitigation potential
Impact Prediction		
° ability of community to cope with change	° qualitative - review of communities in terms of experience with managing urban/ industrial changes and range of services offered; indicate direction of change and considerations affecting possible magnitude	° quantitative approach not possible - no basis for identifying magnitude of change - no direct measure of ability of concerned or comparable communities to cope with OWMC-type facility; magnitude of change highly dependent on perceptions, attitudes and actions of community members ° possible to indicate

TABLE I.6

Method of Application

SENSITIVITY ANALYSIS	METHODS OF APPLICATION	RATIONALE
Impact Prediction (cont'd)		
° ability of community to cope with change (cont'd)		direction of change based on general characteristics of affected communities
° less conservative approach - noise impacts - access roads	° quantitative - take revised estimates of number of residents (as documented in IER report); adjust IER numerical analysis for access road vicinity; incorporate into overall quantitative aggregation	° information change - reflected in suitability level changes
° larger negative property value and out-migration impacts	° quantitative - adjust suitability levels as per analysis undertaken by Economic Base consultant; modify quantitative aggregation accordingly	° consistent with approach employed with Economic Base consultant (Clayton Research Associates Ltd., 1985a, pp.114-116)
Impact Weights		
° industrial designation (greater weight)	° quantitative - treat on-site biology and social impacts as the same for LF-1E and LF-1E/PI-27E ° increase factor ranking for planned and proposed land use - site from 8 to 10	° reflects expectation of industrial development on site in any event ° reflects greater importance attached to future land use

TABLE I.6

Method of Application

SENSITIVITY ANALYSIS	METHODS OF APPLICATION	RATIONALE
Impact Weights (cont'd)		
° industrial designation (deleted for PI-27E) (lower weight)	° quantitative - place - LF-1E and LF-1E/PI-27E at same factor suitability level for planned and proposed land use - site ° place displacement of farms with on-site headquarters for LF-1E and LF-1E/PI-27E at same factor suitability level ° place loss of farmland for LF-1E and LF-1E/PI-27E at same factor suitability level	° factor rankings unchanged - issue is data rather than relative importance of factor ° for land use - planned and proposed land use same for both options ° for displacement of farms and farmland no longer expectation of urban development at PI-27E
° greater weight - displacement of farmland and farms (on-site and partial)	° quantitative - increase factor weight - displacement of farms with on-site headquarters from 3 to 5 ° increase factor weight - loss of farmland (3 to 5) ° increase factor weight - partial displacement of farms from 3 to 5 ° with the exception of disruption of adjacent farms, reduce weights of all site vicinity and community and regional factors by 1 level	° increases weights of displacement of farms to maximum level ° reduce weights of all other site vicinity and community and regional factors - increase importance of displacement ° disruption of adjacent farms still a major concern ° access road factors not part of tradeoff
° less weight - air impacts	° delete air impact factors	° exclusion of factor from analysis reflects lower limit

TABLE I.6

Method of Application

SENSITIVITY ANALYSIS	METHODS OF APPLICATION	RATIONALE
Impact Weights (cont'd)		
° greater weight - natural environmental factors site and site vicinity	° quantitative - increase all natural environmental factors - site and site vicinity to 10	° maximizes weight of natural environmental considerations
° business, agriculture, tourism components of economic base	° quantitative: a) make tourism component weight 30 - same as economic base - no change to agriculture b) make agriculture component weight 30 - same as economic base - no change to tourism c) make tourism and agriculture component weight 30 ° no changes to economic base component	° component weights of economic base an upper limit for increasing the weights for tourism and agriculture components of economic base factor ° no economic data to support a level higher (or even as high) ° regional variations addressed in separate set of weights; no data to support modifying these weights
° alternative positive and negative economic base factor weights	° quantitative - factor weights - factor ranks adjusted as per analysis undertaken by Economic Base consultant; modify quantitative aggregation accordingly	° consistent with approach employed by Economic Base consultant (Clayton Research Associates Ltd., 1985a, pp.121-123)
° reduced weights - community and regional and access road impacts	° quantitative - adjust factor weights for community and regional and access road factor down one level in each case	° reflects moderate change in factor weights; no basis for more than moderate changes ° consistent with approach employed by Agricultural consultant

TABLE I.6

Method of Application

SENSITIVITY ANALYSIS	METHODS OF APPLICATION	RATIONALE
Impact Weights (cont'd)		
° reduced weights - community and regional and access road impacts (cont'd)		(Ecologistics, 1985, pp.166-169)
Impacts - Mitigation and Compensation		
° assumes municipal services and municipal financial impacts mitigable through compensation	° quantitative - exclude municipal finance factor	° consistent with assumption that adverse impacts fully mitigable; difficult to define degree of mitigation; defines upper limit of mitigation potential
° assume on-site impacts mitigable - businesses, residents, farms, natural features, land uses	° quantitative - excludes the following site factors: - displacement of residents - displacement of businesses - existing land use - proposed and planned land use - land use stability - displacement of farms with on-site headquarters - rare species - partial displacement of farms (on-site farms with on-site land) - natural vegetation displaced - potential for occurrence of other significant features	° maximizes estimate of mitigation potential for on-site impacts - upper limit

TABLE I.6

Method of Application

SENSITIVITY ANALYSIS	METHODS OF APPLICATION	RATIONALE
Impacts - Mitigation and Compensation (cont'd)		
° assume impacts on adjacent residents, community and recreation features and farms mitigable through property buy-out program	° quantitative - exclude the following factors: - disruption of use and enjoyment of property and for day-to-day activities adjacent to the site - disruption of operations of community and recreation features (adjacent to the site) - disruption of adjacent farm operations	° upper limit of mitigation potential ° other land use and business factors in site vicinity - no distinction drawn - adjacent and non-adjacent; in practice mitigation potential would be less because of greater displacement impact and greater impact on community cohesion/stability
° assume site vicinity noise impacts largely mitigable (design and operations changes)	° quantitative - reduce nighttime noise levels by 5 dBA; adjust noise and feature counts; modify quantitative aggregation based on changes to IER numerical analysis ° affects two factors: disruption of use and enjoyment of property and/or day-to-day activities (site vicinity) and disruption of operations - community and recreation features (site vicinity)	° adaptation of analysis already undertaken by IER

TABLE I.6

Method of Application

SENSITIVITY ANALYSIS	METHODS OF APPLICATION	RATIONALE
Impacts - Mitigation and Compensation (cont'd)		
° assume property value impacts mitigable (property value protection program)	° quantitative - exclude the factor property value impacts ° no change to other factors	° upper limit of mitigation potential, although property value change potential a consideration with other factors, e.g. disruption of use and enjoyment of property not possible to separate from other forms of potential disruption, e.g. noise, visual
° assume natural environmental site vicinity impacts mitigable (design and operations, habitat creation and enhancement)	° quantitative - exclude the following site vicinity factors: - Significant Environmental Units (SEUs) - other natural vegetation - rare species	° upper limit of mitigation potential
° assume entire site assessed as industrial	° quantitative - incorporate suitability level adjustments as carried out by Clayton Research Associates Ltd.	° consistent with Clayton analysis ° only changes - adjustments to make consistent with other impacts
Future Conditions and Study Area Boundaries		
° future scenarios	° qualitative - indicate general direction of change, general sense of magnitude and likely	° based on data available possible to indicate direction of change of various risks and

TABLE I.6

Method of Application

SENSITIVITY ANALYSIS	METHODS OF APPLICATION	RATIONALE
Future Conditions and Study Area Boundaries		
° future scenarios (cont'd)	implications for siting option ranking	impacts, but not possible to predict magnitude of change
° construction impacts	° qualitative - indicate general direction of change, likely implications for siting option ranking	° based on data available possible to indicate direction of change of impacts, but not possible to predict magnitude of change
° secondary access routes	° qualitative - as above	° as above
° definition of local and regional roads - Niagara Falls	° quantitative - study areas for risk receptors expanded to include the section of QEW between Niagara Roads 24 and 27 ° analysis limited to population, sensitive land uses and road users ° expansion of the study area only affected risk indices for LF-1E/ PI-27E since no wastes or additives/reagents approach sites LF-9C or LF-3C from east of Regional Road 24 on QEW ° details of methods in Appendix H to this volume ° quantitative aggregation on basis of above	° focus on direct receptors reflects greater importance attached to direct exposure risk factors ° analysis adequate for comparative evaluation purposes

TABLE I.6

Method of Application

SENSITIVITY ANALYSIS	METHODS OF APPLICATION	RATIONALE
Future Conditions and Study Area Boundaries (cont'd)		
° transportation - receptors	° quantitative - delete - receptor data for local and regional access routes as undertaken by transportation consultant; modify suitability levels - quantitative aggregation accordingly	° consistent with procedure employed by Transportation consultant; only modified to be consistent with other inputs to quantitative aggregation
Risks, Impacts, Costs		
° greater weight to risks	° progressively increase weight of risks (for study area aggregations) until ranking of siting options changes	° indicates how much importance would have to be attached to risks for same preferred siting option under both quantitative aggregation procedures

TABLE I.7

Sensitivity Analyses Included

SENSITIVITY ANALYSIS	ARGUMENTS FOR INCLUSION	ARGUMENTS AGAINST INCLUSION
Facility Characteristics		
° Haul Methods additives and reagents (road vs. road and rail)	° OWMC may decide to use rail for the haulage of additives and reagents ° rail would reduce transportation risks and impacts	° possible that rail access will not be provided - for comparative purposes better not to underestimate transportation risks and impacts ° even if rail access considered desirable , many approvals to be obtained and agreements to be reached before definite - inclusion premature ° even if rail provided - possible may be discontinued - no change in ranking and minor magnitude change
° Landfill Type (conventional vs. shallow entombment)	° OWMC currently considering shallow entombment technology; shallow entombment choice appears more likely with total solidification ° shallow entombment would enhance natural containment ° adverse site vicinity impacts appear limited based on data available	° firm decision not yet made regarding landfill type; risks and impacts should not be underestimated ° although possible to give general indication of differences, further data regarding off-site risks and impacts required before firm conclusion possible
Risk Prediction		
° Indirect Air Risks	° indirect air risks extremely low severity (10^{-7} or less) ° risks overestimated because of very conservative assumptions ° mitigation potential (if required)	° differences between direct and indirect air risks reflected in factor weighting differences ° important that all major pathways be considered

TABLE I.7

Sensitivity Analyses Included

SENSITIVITY ANALYSIS	ARGUMENTS FOR INCLUSION	ARGUMENTS AGAINST INCLUSION
Risk Prediction		
° Indirect Air Risks - Cont'd	° indirect air risks so low as to be below threshold of consideration; inclusion may distort analyses which should focus on major direct risks and impacts	° some element of uncertainty in all risk predictions ° mitigation cannot be assured ° major agency and public concern
° Chronic Air Risks	° extremely low severity (10^{-6} or less) ° risks overestimated because of very conservative assumptions ° chronic air risks so low as to be below threshold of consideration; inclusion may distort analyses which should focus on acute risks and impacts	° difference within air risks and between air risks and other risks reflected in factor weighting differences ° important that all major pathways be considered ° risk at level (10^{-6}) which should be considered at least in comparative sense ° some element of uncertainty in all risk predictions ° limited mitigation potential ° major agency and public concern
° Susceptibility of Site to Flooding (increase FSLs and factor weight)	° analysis of flood susceptibility indicates that flooding potential not significant for any option, with the exception of LF-3C; however, only two level difference in factor suitability levels ° inclusion of sensitivity analysis would reflect more precisely the	° placing all options, with the exception of LF-3C at same factor suitability level fails to draw flooding potential difference between Milton (LF-4N/PI-13N, LF-4N/PI-1N) and Niagara Falls (LF-1E and LF-1E/PI-27E) options ° current suitability level differences

TABLE I.7

Sensitivity Analyses Included

SENSITIVITY ANALYSIS	ARGUMENTS FOR INCLUSION	ARGUMENTS AGAINST INCLUSION
Risk Prediction		
° Susceptibility of Site to Flooding - Cont'd	magnitude of difference between LF-3C and the remaining options	reflect surface water consultant's judgements regarding magnitude of difference
Risk Weights		
° Local and Regional and Province-Wide Access Routes	° larger population in centres along province-wide system ° certain types of accidents will be more severe because of higher operating speeds ° number of road users is greater ° could be argued that weighting arguments balance out and factors should be ranked equally	° risks potentially more severe because people and sensitive uses are closer, greater level of pedestrian, school bus and agricultural traffic ° greater concern regarding frequency because OWMC traffic a higher proportion of total traffic, function of roads less consistent with haulage of dangerous goods and wastes and lower design standard ° evacuation more difficult on local and regional roads because residents are closer and access directly to local and regional roads ° local and regional roads perceived to be greater concern by public
° Transportation (Less Weight)	° limited transportation risk differences across all options; differences among options for spills posing potential risks to human health and fatal or personal injury accidents for total transportation	° with natural containment and transportation risk factors (local and regional - spills and accidents) no clear difference based on severity, frequency or mitigation potential

TABLE I.7

Sensitivity Analyses Included

SENSITIVITY ANALYSIS	ARGUMENTS FOR INCLUSION	ARGUMENTS AGAINST INCLUSION
Risk Weights		
° Transportation (Less Weight) - Cont'd	system too small to be statistically significant ° very limited transportation risk differences among four most highly ranked options - for total spill and accident frequency ° depending on definition of local and regional roads either West Lincoln or Niagara Falls options would be favoured ° natural containment more long-term risk - post-closure period	° both natural containment and transportation highly ranked concerns at OWMC workshops; transportation actually ranked higher than natural containment ° differences among options reflected in factor suitability level differences
Risk Mitigation		
° Susceptibility of Site to Flooding (delete factor)	° only siting option considered susceptible to flooding - LF-3C ° the boundary refinements excluded the flood-prone portion of the site (GLAL, 1985c, p.26)	° even though flood-prone area excluded, the site was "considered to have major constraints due to flood susceptibility as a result of the proximity of the Beaver Creek and Welland River floodplains" (GLAL, 1985c, p.122) ° mitigation potential reflected in factor ranking ° flooding and mitigation potential predictions not absolutely certain

TABLE I.7

Sensitivity Analyses Included

SENSITIVITY ANALYSIS	ARGUMENTS FOR INCLUSION	ARGUMENTS AGAINST INCLUSION
Risk Mitigation (Cont'd)		
° Ground and Surface Water Use (including susceptibility to flooding)- delete factor	° if flooding potential risk mitigable and ground water risks addressed by natural containment, not necessary to include ground and surface water use factors - concern mitigable ° severity of ground water and surface water risk dependent on natural containment and flooding potential provided all sites involve some ground water or surface water use ° frequency of use difficult to control and can change over time ° mitigation potential - notification alternative sources and dilution	° sites vary in the natural containment provided; the less the natural containment, the greater the importance of ground and surface water use ° natural containment does not prevent risk; reduces risk ° flooding and natural containment predictions and conclusions regarding mitigation potential not absolutely certain ° importance of ground and surface water use already reflected in factor ranking
° Acute air risks	° probability of events extremely low	° severity of potential effects is high ° importance of acute risks is already reflected in factor rankings
Impact Prediction		
° Ability of Community to Cope with Change	° concern not addressed directly by any factor or combination of factors ° reflects unique nature of OWMC facility ° reflects qualitative differences	° experience with changes reflected in social, land use and agricultural stability factors ° experience with urban-industrial growth reflected in agricultural

TABLE I.7

Sensitivity Analyses Included

SENSITIVITY ANALYSIS	ARGUMENTS FOR INCLUSION	ARGUMENTS AGAINST INCLUSION
Impact Prediction (Cont'd)		
° Ability of Community to Cope with Change - Cont'd	among communities in experience with change, with urban-industrial development and with special waste facilities and in potential variations in ability to cope with and manage such changes	community and land use character factor ° municipal service differences noted in municipal finance factors; concern mitigable to the extent that OWMC facility is unique and ability to cope not reflected in factors listed above; no data base upon which to base impact predictions - direction or magnitude
Impact Weights		
° Industrial Designation (greater weight)	° consistent with local and regional land use policies ° possible expectation on the part of local residents and businesses of industrial development at PI-27E	° importance of industrial land already reflected in factor weights and factor suitability levels ° local land use policies were changed (for site PI-27E) during Phase 4A ° industrial development potential of PI-27E very limited in view of large supply of industrial land in Niagara Falls and slow pattern of industrial growth
° Industrial Designation (deleted for PI-27E) (lower weight)	° reflects potential change by City of Niagara Falls at some point in the future; consistent with perception of	° possibility that potential for designation change more a reflection of expectations regarding timing of

TABLE I.7

Sensitivity Analyses Included

SENSITIVITY ANALYSIS	ARGUMENTS FOR INCLUSION	ARGUMENTS AGAINST INCLUSION
Impact Weights (Cont'd)		
° Industrial Designation (deleted for PI-27E (lower weight) - Cont'd	large supply of industrial land and slow pattern of industrial growth	development than ultimate end use ° judgement of land use planning consultant that industrial designation appropriate to and, for comparative analysis purposes, should not be changed
° Greater Weight-Natural Environmental Factors - Site and Site Vicinity	° high number of socio-economic disciplines (social, land use, agriculture, economic base, municipal finance) collectively tend to outweigh natural environmental impacts	° highly sensitive/significant natural features largely excluded during previous site selection stages ° natural environmental impacts moderate and, to some extent, mitigable ° with the exception of one option, limited differences among options ° tradeoff between natural environmental impact and collective socio-economic impacts addressed in disciplinary synthesis (Chapter 6)
° Business, Agriculture, Tourism Components of Economic Base	° tourism and agriculture more vulnerable components of economy ° special provincial status of tourism and agriculture in Niagara Region ° reflects uncertainties regarding	° economic base larger share of total economy than agriculture or tourism ° greater mitigation potential with agriculture and tourism ° local economy differences reflected

TABLE I.7

Sensitivity Analyses Included

SENSITIVITY ANALYSIS	ARGUMENTS FOR INCLUSION	ARGUMENTS AGAINST INCLUSION
Impact Weights (Cont'd)		
° Business, Agriculture, Tourism Components of Economic Base - Cont'd	nature and magnitude of potential impacts as well as potential for mitigation ° tourism and agriculture - provincial and local concern	in municipal weights ° impact differences reflected in factor suitability level differences ° weights reflect judgement of economic consultant (See Appendix E)
° Reduced Weights - Community and Regional and Access Road Impacts	° reflects moderate more indirect and perceived nature of such impacts ° reflects public input at OWMC workshops ° subject to alternative interpretation	° access road and community and regional concerns received less attention in previous site selection stages than did site and immediate site vicinity impacts ° although indirect and perceived, impacts still could affect behaviour ° differences between direct and indirect impact factors already reflected in factor weights
° Greater Weights - displacement of farmland and farms	° reflects agency concern regarding loss of farms and farmland ° even small loss of farmland can be considered significant	° highly sensitive/significant foodlands excluded during previous site selection stages ° amount of land displaced limited when viewed in both a regional and provincial context

TABLE I.7

Sensitivity Analyses Included

SENSITIVITY ANALYSIS	ARGUMENTS FOR INCLUSION	ARGUMENTS AGAINST INCLUSION
Impacts - Mitigation and *Compensation*		
° Assume Municipal Services and Municipal Financial Impacts Mitigable Through Compensation	° impacts moderate and positive ° to the extent that not positive, OWMC commitment that no municipality will suffer financially ° top four ranked options all have clearly positive municipal financial impacts	° moderate importance of factor already reflected in factor weights ° considerable differences among options ° both positive and negative impacts should be considered ° although commitment that adverse municipal financial impacts will be offset, positive impacts not equivalent
° Assume On-Site Impacts Mitigable - businesses, residents, farms, natural features, land uses	° compensation paid to displaced people and uses ° possible to mitigate displacement of biological resources ° appeal procedures for people who feel compensation inadequate ° displacement of farmland (permanent resource loss) not included	° a severe direct impact ° not all impacts financially compensatible ° limits to which equivalent circumstances can be provided ° disruptive effects of relocation both for those displaced and for those remaining ° adequacy of financial compensation - a matter of interpretation - perceptions
° Assume impacts on adjacent residents, community and recreation features and farms mitigable through property buy-out program	° property buy-out program under consideration by OWMC ° important to consider potential of such a program	° program may not be introduced ° conservative approach considered more prudent

TABLE I.7

Sensitivity Analyses Included

SENSITIVITY ANALYSIS	ARGUMENTS FOR INCLUSION	ARGUMENTS AGAINST INCLUSION
Impacts - Mitigation and Compensation (Cont'd)		
° Assume Property Value Impacts Mitigable (Property Value Protection Program)	° property value protection program under consideration by OWMC ° important to consider potential of such a program	° program may not be introduced if program assumed negative, impacts may be underestimated ° if and extent to which property values will depreciate, a matter of perception and interpretation ° not clear geographic extent of such a program ° in view of opportunities, conservative approach considered more prudent
Future Conditions and Study Area Boundaries		
° Future Scenarios	° facility will not likely be established until approximately 1991, nor will it reach maximum operations until approximately 2001 ° existing conditions could change substantially during that period ° not all changes reflected in traffic forecasts and land use designations	° only basis for future scenarios historical patterns of change ° presumably municipalities aware of patterns of change in the formulation of official plan policies and designations ° official plan policies and designations already incorporated into factors
° Secondary Access Routes	° varies by siting option ° OWMC does not have complete control over off-site truck movements	° very limited use of secondary roads, even in West Lincoln ° no ranking change ° slight magnitude change

TABLE I.7

Sensitivity Analyses Included

SENSITIVITY ANALYSIS	ARGUMENTS FOR INCLUSION	ARGUMENTS AGAINST INCLUSION
Future Conditions and Study Area Boundaries (Cont'd)		
° Definition of Local and Regional Roads - Niagara Falls	° minimizes overall likelihood of events and exposure ° compares portions of routes unique to each option ° takes into consideration major population concentrations along province-wide routes ° recognizes that with province-wide routes certain types of accidents will be more severe because of higher operating speed and that number of road users is greater	° OWMC generated traffic a higher proportion of total traffic with local and regional roads than with freeways ° function of roads less consistent with haulage of special wastes ° people and sensitive uses tend to be closer to the road ° lower design standards ° greater level of pedestrian, school bus and agricultural use ° transportation of special wastes to a greater extent on 400-series highways - more consistent with role of roads
° Transportation - receptors	° likelihood of events occuring at all very limited ° if event occurs, strong likelihood of mitigation potential prior to exposure and impact ° risk receptors counted on local and regional access routes, but not for province-wide access routes ° consideration of such risks may distort analysis which should focus on major direct risks and impacts	° mitigation cannot be assured ° differences in importance of direct and indirect risks already reflected in factor and indicator weights

TABLE I.7

Sensitivity Analyses Included

SENSITIVITY ANALYSIS	ARGUMENTS FOR INCLUSION	ARGUMENTS AGAINST INCLUSION
Risks, Impacts, Costs		
° Greater Weight - Risks	° reflects fact that OWMC ranks risks more highly than impacts ° reflects risk potential and uncertainty regarding risk predictions and mitigation potential	° risks already highly ranked ° risks minimized through design, operations and previous site selection stages ° acute risks very infrequent with mitigation potential ° long-term air risks acceptable ° flooding risks mitigable ° ground water risks minimized through natural containment

TABLE I.8
Qualitative Sensitivity Analyses - Facility Characteristics

SENSITIVITY ANALYSES	DISCIPLINE	CHANGES IN SITING OPTION RANKINGS			CHANGES IN DIRECTION			COMMENTS AND CONCLUSIONS
Facility Characteristics								
° Haul Methods (road vs. road and rail)	° Transportation	° ranking changes			° aggregated factor values			° aggregated factor values reduced where rail available ° positions of LF-4N/PI-13N and LF-4N/PI-1N reversed ° LF-1E/PI-27E slightly preferred to LF-1E
			From	To		From	To	
		LF-4N/ PI-13N	1	1	LF-4N/ PI-13N	-55.4	-55.4	
		LF-4N/ PI-1N	2	1	LF-4N/ PI-1N	-58.4	-53.0	
		LF-3C	6	6	LF-3C	-152.0	-135.0	
		LF-9C	5	5	LF-9C	-137.0	-120.8	
		LF-1E	3	4	LF-1E	-84.0	-73.3	
		LF-1E/ PI-27E	3	3	LF-1E/ PI-27E	-84.0	-73.0	
	° Surface Water	° no ranking changes			° minor change in magnitude - LF-9C - two small stream crossings ° no surface water impacts - PI-1N, LF-3C, LF-1E, PI-27E			° negligible change
	° Hydrogeology	° no ranking changes			° no magnitude changes			° no hydrogeologic impacts
	° Social	° sufficient analysis not undertaken to determine effect on overall ranking of siting options			° reinforces preference for LF-1E and LF-1E/PI-27E ° LF-3C becomes slightly more attractive ° LF-4N/PI-1N and LF-1E become slightly less attractive ° LF-4N/PI-13N becomes less			° moderate magnitude changes favouring LF-1E, LF-1E/PI-27E and LF-3C

TABLE I.8

Qualitative Sensitivity Analyses - Facility Characteristics

SENSITIVITY ANALYSES	DISCIPLINE	CHANGES IN SITING OPTION RANKINGS	CHANGES IN DIRECTION	COMMENTS AND CONCLUSIONS
Facility Characteristics ° Haul Methods (road vs. road and rail) - cont'd			attractive ° PI-27E and LF-3C - no impacts	
	° Land Use	° no ranking changes LF-1E/PI-27E 1 LF-1E 2 LF-9C 3 LF-4N/PI-1N and LF-3C 4 LF-4N/PI-13N 6	° no land use impacts - PI-1N, LF-3C, LF-1E and PI-27E ° one commercial use impacted - LF-9C	° no change in ranking and negligible change in magnitude
	° Agriculture	° no ranking changes LF-1E/PI-27E 1 LF-1E 2 LF-4N/PI-1N 3 LF-9C 4 LF-4N/PI-13N 5 LF-3C 6	° narrows gap between LF-1E and LF-1E/PI-27E ° narrows gap between LF-3C and LF-4N/PI-1N ° narrows gap between LF-4N/PI-13N and LF-3C ° widens gap between LF-4N/PI-1N and LF-9C	° no change in rankings ° magnitude differences favours LF-1E/PI-27E, LF-3C and LF-4N/PI-1N
	° Biology	° no ranking changes LF-4N/PI-1N 1 LF-9C 2 LF-4N/PI-13N 3 LF-3C 4 LF-1E 5 LF-1E/PI-27E 6	° gap between LF-9C and LF-4N/PI-1N narrows ° no impacts - PI-27E ° very minor impacts PI-1N, LF-3C, LF-1E ° minor impacts - LF-9C	° minor magnitude change - LF-9C
	° Engineering	° no ranking changes	° negligible differences in capital costs	° negligible changes

TABLE I.8

Qualitative Sensitivity Analyses - Facility Characteristics

SENSITIVITY ANALYSES	DISCIPLINE	CHANGES IN SITING OPTION RANKINGS	CHANGES IN DIRECTION	COMMENTS AND CONCLUSIONS
Facility Characteristics				
° Haul Methods (road vs. road and rail) cont'd	° Overall	° no change in overall ranking	° LF-9C becomes slightly less desirable ° LF-4N/PI-13N even less desirable	° overall transportation risk reduction ° minor change
° Waste Quantities (150,000 t/a vs. 300,000 t/a)	° Transportation	° no ranking changes LF-4N/PI-13N 1 LF-4N/PI-1N 2 LF-1E and LF-1E/PI-27E 3 LF-9C 5 LF-3C 6	° slightly narrows gap between Niagara Falls options and Milton options ° slightly narrows gap between West Lincoln and Milton options	° very slight magnitude changes ° no change in receptors or perceptions
	° Municipal Finance	° no ranking changes LF-9C 1 LF-3C 2 LF-1E 3 LF-1E/PI-27E 4 LF-4N/PI-1N 5 LF-4N/PI-13N 6	From To LF-9C 5.0 5.0 LF-3C 4.9 4.8 LF-1E 2.2 2.9 LF-1E/PI-27E 2.3 2.1 LF-4N/PI-1N 0.2 -0.2 LF-4N/PI-13N 0.1 -0.3	° no change in siting option rankings ° negligible change in magnitude of difference ° Milton options shift from slightly positive to slightly negative-mitigable impact

TABLE I.8
Qualitative Sensitivity Analyses - Facility Characteristics

SENSITIVITY ANALYSES	DISCIPLINE	CHANGES IN SITING OPTION RANKINGS	CHANGES IN DIRECTION	COMMENTS AND CONCLUSIONS
Facility Characteristics				
• Waste Quantities (150,000 t/a vs. 300,000 t/a) cont'd	• Air Dispersion/Air Quality (Risks)	• no ranking changes Risks Impacts LF-3C 1 1 LF-9C 2 9C (1) and LF-1E 1E (2) LF-1E/PI-27E 4 6 LF-4N/PI-1N 5 5 LF-4N/PI-13N 6 4	• risk - negligible change • impact - impacts on existing and anticipated air quality slightly less for LF-1E/PI-27E	• overall reduction in air risks • very slight magnitude change
	• Overall	• no change in overall ranking	• very slight magnitude change	• negligible change
• Technology (partial vs. total solidification)	• Transportation	• no ranking changes	• aggregated factor values	• overall reduction in transportation risk • no change in ranking • negligible magnitude differences
		From To	From To	
		LF-4N/PI-13N 1 1	LF-4N/PI-13N -55.4 -51.8	
		LF-4N/PI-1N 2 2	LF-4N/PI-1N -58.4 -54.6	
		LF-1E/PI-27E 3 3	LF-1E/PI-27E -84.0 -78.0	
		LF-1E 3 4	LF-1E -84.0 -78.6	
		LF-9C 5 5	LF-9C -137.0 -128.7	
		LF-3C 6 6	LF-3C -152.0 -143.2	
	• Hydrogeology	• no ranking change	• no magnitude change	• no change

TABLE I.8
Qualitative Sensitivity Analyses - Facility Characteristics

SENSITIVITY ANALYSES	DISCIPLINE	CHANGES IN SITING OPTION RANKINGS	CHANGES IN DIRECTION	COMMENTS AND CONCLUSIONS
Facility Characteristics				
• Technology (partial vs. total solidification) cont'd	• Air	• ranking changes unknown	• magnitude changes unknown	• effects largely confined on-site • limited potential - fogging and icing - off-site • slight increase in downwind contaminant concentrations • additional information required on composition and significance of emissions • although effects anticipated to be minimal, insufficient data to assess ranking and magnitude differences
	• Surface Water	• no ranking change	• no magnitude change	• no change; assumed that no difference in surface water discharges
	• Social	• no ranking change	• to the extent that fogging and icing occurs - favours options with fewest residents in area - LF-1E, LF-9C, LF-3C • magnitude differences likely to be minimal but further data required for firm conclusion	• reduced noise impacts on access roads • visual impacts - visible plume • no ranking change • magnitude change dependent on additional data
	• Economic Base	• slight ranking change From / To LF-9C 1 1 LF-1E 2 3 LF-1E/PI-27E 3 2	• no change in magnitudes beyond LF-1E and LF-1E/PI-27E changes	• positions of LF-1E and LF-1E/PI-27E reversed • potentially larger negative property value impacts and out-migration

TABLE I.8
Qualitative Sensitivity Analyses - Facility Characteristics

SENSITIVITY ANALYSES	DISCIPLINE	CHANGES IN SITING OPTION RANKINGS	CHANGES IN DIRECTION	COMMENTS AND CONCLUSIONS
Facility Characteristics				
• Technology (partial vs. total solidification) cont'd	• Municipal Finance	• no ranking change	• no magnitude change	• payment-in-lieu increases balance out, potential reductions property values and greater out-migration • negligible change
	• Land Use	• no ranking change	• no magnitude change	• no significant additional land use impacts expected
	• Agriculture	• no ranking change	• no magnitude change	• no significant additional impacts expected
	• Biology	• no ranking change	• no magnitude change	• no significant additional impacts expected
	• Engineering	• no ranking change	• no appreciable magnitude change • cost spread is less than that for total; cost (present value of life cycle annual costs 1984 Canadian dollars X million) are 7% and 9% for total and partial solidification - respectively	• no ranking of magnitude change • landfill lives increase for all options Total Partial LF-4N/PI-1N 15.5 24.5 LF-4N/PI-13N 15.5 24.5 LF-3C 19.0 32.5 LF-9C 14.0 23.5 LF-1E 12.0 21.0 LF-1E/PI-27E 11.0 19.5

TABLE I.8

Qualitative Sensitivity Analyses - Facility Characteristics

SENSITIVITY ANALYSES	DISCIPLINE	CHANGES IN SITING OPTION RANKINGS	CHANGES IN DIRECTION	COMMENTS AND CONCLUSIONS
Facility Characteristics				
• Technology (partial vs. total solidification) cont'd	• Overall	• no ranking change; some uncertainty regarding off-site air risks and impacts	• magnitude of change expected to be limited; some uncertainties requiring further data and analysis	• overall improvement in transportation risk and landfill lives • off-site air risks and impacts expected to be minimal but additional data and analysis change before firm conclusions can be reached • if partial solidification option selected important that analysis be brought to equivalent level of detail as total solidification
• Stack Height (60 m vs. 100 m)	• Social-Visual	• no change in siting option ranking LF-1E 1 LF-3C 2 LF-1E/PI-27E 3 LF-9C 4 LF-4N/PI-1N 5 LF-4N/PI-13N 6	• position of Milton options improves slightly	• negligible change • visual impact - lowest ranked indicator within community character factor
	• Air Quality/Air Dispersion	• no ranking change	• no magnitude change	• negligible change
	• Economic Base	• no ranking change	• no magnitude change	• negligible change
	• Overall	• no ranking change	• no magnitude change	• negligible change

TABLE I.8
Qualitative Sensitivity Analyses - Facility Characteristics

SENSITIVITY ANALYSES	DISCIPLINE	CHANGES IN SITING OPTION RANKINGS	CHANGES IN DIRECTION	COMMENTS AND CONCLUSIONS
Facility Characteristics				
• Waste sources (scenario 1 vs. scenario 2)	• Transportation	• no ranking change LF-4N/PI-13N 1 LF-4N/PI-1N 2 LF-1E 3 LF-1E/PI-27E 3 LF-9C 5 LF-3C 5	• widens gap between Milton siting options and West Lincoln/Niagara Falls options • negligible change between West Lincoln and Niagara Falls options • only slight changes for one way annual vehicle kilometres and accident frequency along local and regional access roads	• no ranking change • magnitude widens gap between Milton and other options • substantial overall increase in transportation costs (from $6.9 to $9.6 million), increase in annual accident rates (270% to 598% increase); scenario 1 results in an increase in vehicle - kilometres of haulage for special wastes over the province-wide access system ranging from 264% to 382%
	• Social/Land Use/ Agricultural	• no ranking change	• in all cases, widens gap between Niagara Falls options - ranked 1 and 2, and other options; greater increase in traffic related impacts on local and regional roads	• no change in ranking, but magnitude change
	• Overall	• no ranking change	• widens gap between Milton and West Lincoln/Niagara Falls for risks • widens gap between Niagara Falls and Milton/West Lincoln for impacts	• risks largely addressed by sensitivity analyses - progressively greater weight - transportation risk factors • impacts largely addressed by conservative approach - transportation impact prediction
• Landfill Type (conventional vs. shallow entombment)	• Hydrogeology	• ranking unchanged for LF-3C and LF-9C • the selection of a shallow entombed technology would result in the exclusion of LF-4N and LF-1E	• no magnitude of difference - changes between LF-3C and LF-9C • LF-4N and LF-1E excluded	• greater natural containment with shallow entombed technology

TABLE I.8
Qualitative Sensitivity Analyses - Facility Characteristics

SENSITIVITY ANALYSES	DISCIPLINE	CHANGES IN SITING OPTION RANKINGS	CHANGES IN DIRECTION	COMMENTS AND CONCLUSIONS
Facility Characteristics				
° Landfill Type (conventional vs. shallow entombment) cont'd	° Social/Land Use/ Agricultural	° ranking unchanged for LF-3C and LF-9C	° insufficient data to determine magnitude of change in relative or absolute terms	
	° Overall	° no ranking change	° magnitude of change differences would require further analysis	° no ranking difference, but additional data and analysis required to confirm conclusions and to refine basis for conclusions ° if shallow entombed selected, important that analysis be brought to same level of detail as conventional analysis

TABLE I.9

Qualitative Sensitivity Analyses - Risk Prediction

SENSITIVITY ANALYSES	DISCIPLINE	CHANGES IN SITING OPTION RANKINGS	CHANGES IN DIRECTION	COMMENTS AND CONCLUSIONS
Risk Prediction • Direct and indirect chronic air (greater weight to direct air pathways)	• Air Quality/ Air Dispersion	• change to ranking of siting options Base Case / Alternative Weighting Scheme LF-3C 1 1 LF-9C 2 2 LF-1E 3 3 LF-1E/PI-27E 4 5 LF-4N/PI-1N 6 5 LF-4N/PI-13N 5 4	• more distinct preference for LF-3C and LF-9C than with base case • LF-1E/PI-27E becomes lowest ranked siting option, along with LF-4N/PI-1N • clear difference between Niagara Falls options with LF-1E clearly preferred	• ranking change; rankings of LF-4N/PI-13N and LF-1E/PI-27E become revised; LF-1E/PI-27E becomes lowest ranked siting option, along with LF-4N/PI-1N

TABLE I.10
Qualitative Sensitivity Analyses - Impact Prediction

SENSITIVITY ANALYSES	DISCIPLINE	CHANGES IN SITING OPTION RANKINGS	CHANGES IN DIRECTION	COMMENTS AND CONCLUSIONS
Impact Prediction				
° *Ability of* Community to Cope with Change	° Social/Land Use/ Agriculture/ Economic Base	° no change in siting option ranking	° widens gap between Niagara Falls options and West Lincoln options	° West Lincoln - limited community change and limited experience with industrial type development ° Niagara Falls - moderate change, but experience with industrial type development ° Milton - pattern of change, but limited experience (in site vicinity) with industrial type development
	° Municipal Finance	° no ranking change LF-9C 1 LF-3C 2 LF-1E 3 LF-1E/PI-27E 4 LF-4N/PI-1N 5 LF-4N/PI-13N 6	° narrows gap between West Lincoln options and Niagara Falls and, to a lesser, Milton options	° West Lincoln has more limited range of services and expertise; more difficult to cope with inquiries, monitoring role, services related to in-migration and out-migration; property value changes and land use control requirements ° Milton has experience with managing growth and Niagara Falls experienced with managing urban/industrial development
	° Overall	° no change in siting option ranking	° differences favour Niagara Falls and, to a lesser extent, Milton over West Lincoln options	° no change in siting option ranking; magnitude of difference difficult to precisely define ° important that considered in future, particularly with the selection of LF-9C by OWMC

TABLE I.11
Qualitative Sensitivity Analyses - Future Conditions and Study Area Boundaries

SENSITIVITY ANALYSES	DISCIPLINE	CHANGES IN SITING OPTION RANKINGS	CHANGES IN DIRECTION	COMMENTS AND CONCLUSIONS
Future Conditions and Study Area Boundaries				
° Future Scenarios	° Social	° no change in siting option ranking LF-1E 1 LF-1E/PI-27E 2 LF-9C 3 LF-4N/PI-1N 4 LF-4N/PI-13N 5 LF-3C 6	° would tend to slightly widen gap between Milton options and more highly ranked options and narrow gap between Milton options and LF-3C	° some additional non-farm and rural estate development likely in vicinity of Milton option, although most such development will be directed to hamlets; potential future residential development on the west side of Fourth Line between Highway 401 and Derry Road West ° limited change expected in vicinity of either West Lincoln or Niagara Falls (IER, 1985a, pp.F1-24)
	° Land Use	° no change in siting option ranking LF-1E/PI-27E 1 LF-1E 2 LF-9C 3 LF-4N/PI-1N and LF-3C 4 LF-4N/PI-13N 5	° would tend to widen gap between Milton option and more highly ranked options	° Milton - rates of growth in residential and industrial development will be highest around the Milton candidate sites; anticipated that vacant residential lands within the Milton Urban Area, within 5 km of the candidate sites, will be completely developed by the year 2001; minimum industrial growth within 5 km of candidate sites due to lack of designated industrial lands (LKA, 1985, p.144-145) ° West Lincoln - no urban residential or industrial development anticipated within 5 km of the candidate sites by the year 2001; rates of population growth in hamlet and rural area expected to continue at historical levels

TABLE I.11
Qualitative Sensitivity Analyses - Future Conditions and Study Area Boundaries

SENSITIVITY ANALYSES	DISCIPLINE	CHANGES IN SITING OPTION RANKINGS	CHANGES IN DIRECTION	COMMENTS AND CONCLUSIONS
Future Conditions and Study Area Boundaries				
• Future Scenarios - Cont'd	• Land Use			• Niagara Falls - industrial and residential growth to occur at very low levels; minimum industrial growth anticipated within 5 km of candidate sites due to surplus of vacant industrial land (LKA, 1985, p.144-145)
	• Agriculture	• no change in ranking LF-1E/PI-27E 1 LF-1E 2 LF-4N/PI-1N 3 LF-9C 4 LF-4N/PI-13N 5 LF-3C 6	• very slight magnitude change • relative position of Niagara Falls expected to increase slightly with long-term increase in industrial and non-agricultural uses • agricultural conflicts will remain in Milton and West Lincoln areas	• Milton - population growth primarily within urban boundaries - Oakville and Milton; limited hamlet growth or rural severences; uncertainty re. OLC land; with the exception of speciality crops along Trafalgar Road, agricultural actively will continue (largely cash crops on rented land); however, land will remain underutilized because of land fragmentation, short-term leases and limited investment in land improvements • West Lincoln - expected to remain solid rural character with increasing agricultural productivity • Niagara Falls - gradual industrial and non-agricultural use development; little if any increase in agricultural utilization and productivity around LF-1E/PI-27E

TABLE I.11
Qualitative Sensitivity Analyses - Future Conditions and Study Area Boundaries

SENSITIVITY ANALYSES	DISCIPLINE	CHANGES IN SITING OPTION RANKINGS	CHANGES IN DIRECTION	COMMENTS AND CONCLUSIONS
Future Conditions and Study Area Boundaries				
° Future Scenarios - Cont'd	° Economic Base	° no change in ranking LF-9C 1 LF-1E 2 LF-1E/PI-27E 3 LF-3C 4 LF-4N/PI-1N 5 LF-4N/PI-13N 6	° to the extent that new industry may be attracted to PI-27E area - relative position of LF-1E/PI-27E improves (Clayton, 1985a, p.127)	° Milton - growth constrained by sewage treatment capacity; modest growth over next decade expected; industrial structure expected to shift to service sector (Clayton, 1985a, pp.125-126) ° West Lincoln - stable agricultural community; slow population growth expected over next decade without dramatic changes in economic structure ° Niagara Falls - population and industrial growth expected to be modest over the next decade; full municipal services increase possibility of industrial development of PI-27E (Clayton, 1985a, p.125-126)
	° Municipal Finance	° no ranking change LF-9C 1 LF-3C 2 LF-1E 3 LF-1E/PI-27E 4 LF-4N/PI-1N 5 LF-4N/PI-13N 6	° minimal change in magnitude	° Milton - Milton's growth constrained until sewage treatment plant expands; faster growth of Halton should result in a relatively large assessment base in Halton over which to spread regional operating costs; impacts of OWMC facilities in the Region of Halton operating costs would tend to be lower than for base case ° West Lincoln - no base case change expected; stable agricultural community; slow population growth expected over next decade without any dramatic changes in economic structure

TABLE I.11
Qualitative Sensitivity Analyses - Future Conditions and Study Area Boundaries

SENSITIVITY ANALYSES	DISCIPLINE	CHANGES IN SITING OPTION RANKINGS	CHANGES IN DIRECTION	COMMENTS AND CONCLUSIONS
Future Conditions and Study Area Boundaries • Future Scenarios - Cont'd	• Municipal Finance			• Niagara Falls - no base case change expected; no change in population or economic base anticipated; population and industrial growth is expected to be modest over the next decade (Clayton, 1985b, p.108)
	• Overall	• no change in siting option ranking	• tends to improve slightly relative position of Niagara Falls options for social, agricultural, land use, and economic base considerations; changes in Niagara Falls are limited by low levels of industrial and residential growth and surplus of industrial land • relative position of Milton options reduced by modest increase in potential long-term land use and social impacts; magnitude of conflict limited by servicing constraints and land use conflicts; partially offset by municipal finance improvements • no change in base conditions - West Lincoln	• no ranking changes • limited changes in magnitude

TABLE I.11
Qualitative Sensitivity Analyses - Future Conditions and Study Area Boundaries

SENSITIVITY ANALYSES	DISCIPLINE	CHANGES IN SITING OPTION RANKINGS	CHANGES IN DIRECTION	COMMENTS AND CONCLUSIONS
Future Conditions and Study Area Boundaries				
° Construction Impacts	° Social	° no ranking changes LF-1E 1 LF-1E/PI-27E 2 LF-9C 3 LF-4N/PI-1N 4 LF-4N/PI-13N 5 LF-3C 6	° gap between Niagara Falls siting options and West Lincoln and LF-4N/PI-13N siting option increases; widens gap between LF-1E and LF-1E/PI-27E and narrows gap between LF-1E/PI-27E and LF-9C	° more residents and features in the vicinity of LF-4N/PI-13N and LF-1E/PI-27E ° more residents and features along local and regional access roads to West Lincoln and, to a lesser extent, Milton options ° recognized that construction nuisance effects partially mitigable ° limited social impacts expected from influx of a temporary workforce (IER, 1985a, p.312)
	° Land Use	° no ranking change	° no appreciable magnitude change	° construction impacts considered to be limited, short-term and partially mitigable
	° Biology	° no ranking change LF-4N/PI-1N 1 LF-9C 2 LF-4N/PI-13N 3 LF-3C 4 LF-1E 5 LF-1E/PI-27E 6	° widens gap between LF-1E/PI-27E and most highly ranked option	° potential on-site construction impacts - vegetation removal, erosion and siltation, machinery noise, alteration of soil moisture regimes and wildlife barrier; greatest impacts for LF-1E/PI-27E since involves greatest displacement of natural vegetation ° potential site vicinity construction impacts - loss on-site drainage, drainage courses and siltation, machinery noise, alterations of soil moisture regimes and wildlife barrier from fencing; impacts greatest with LF-1E/PI-27E due to large extent of SEUs and other natural vegetation ° recognized that there is mitigation potential

TABLE I.11

Qualitative Sensitivity Analyses - Future Conditions and Study Area Boundaries

SENSITIVITY ANALYSES	DISCIPLINE	CHANGES IN SITING OPTION RANKINGS	CHANGES IN DIRECTION	COMMENTS AND CONCLUSIONS
Future Conditions and Study Area Boundaries				
• Construction Impacts - Cont'd	• Overall	• no ranking change	• social impacts favour Niagara Falls options • natural environment impacts favour West Lincoln and Milton options • no clear pattern	• in absolute terms impacts expected to be minor, short-term and partially mitigable • no ranking change; magnitude changes minor and, to some extent, balance out
• Secondary Access Routes	• Transportation	• no ranking change LF-4N/PI-13N 1 LF-4N/PI-1N 2 LF-1E 3 LF-1E/PI-27E 3 LF-9C 4 LF-3C 5	• gap between Niagara Falls siting options and West Lincoln siting options widens	• very limited use of secondary routes expected in West Lincoln: Route and Direction of Approach — Number of Trucks/Day 1. from southwest on Niagara Regional Road 10 — 1 every 3 days 2. from the south and southeast on Regional Road 24 to Highway 20 intersection — 7 3. from the northeast via QEW and Regional Road 24 — 6.2 4. from the northeast and east on Highway 20 to Highway 20/Regional Road 24 intersection — 11 TOTAL (approximately) — 25

TABLE I.11
Qualitative Sensitivity Analyses - Future Conditions and Study Area Boundaries

SENSITIVITY ANALYSES	DISCIPLINE	CHANGES IN SITING OPTION RANKINGS	CHANGES IN DIRECTION	COMMENTS AND CONCLUSIONS
Future Conditions and Study Area Boundaries				
• Secondary Access Routes - West Lincoln - Cont'd	• Transportation			• as with LF-9C and LF-3C, some secondary access route use is anticipated for all sites • for the Niagara Falls sites, shipments from, for example, Welland and Port Colborne areas would likely be secondary access routes
	• Social/Land Use/ Agriculture	• no ranking change	• gap between Niagara Falls and West Lincoln siting options widens	• magnitude change moderate
	• Overall	• no ranking change	• gap between Niagara Falls and West Lincoln siting options widens; extent of change slight because of very limited use of secondary routes even in West Lincoln	• no ranking change • slight magnitude change favouring Niagara Falls over West Lincoln siting options

TABLE I.12

Summary Results of Quantitative Sensitivity Analyses - Risks

Sensitivity Analysis		Aggregation by Discipline						Aggregation By Study Area					
		LF-3C	LF-1E	LF-9C	LF-1E/ PI-27E	LF-4N/ PI-1N	LF-4N/ PI-13N	LF-3C	LF-1E	LF-9C	LF-1E/ PI-27E	LF-4N/ PI-1N	LF-4N/ PI-13N
Base Case	Score	-115.6	-114.8	-106.2	-121.6	-143.3	-164.3	-81.9	-73.0	-77.0	-75.3	-85.7	-96.4
	Rank[1]	3	2	1	4	5	6	4	1	3	2	5	6
Risk Prediction													
1) Indirect air risks (delete factors)	Score	-113.8	-118.3	-106.8	-135.8	-154.9	-176.7	-80.9	-75.0	-77.4	-83.5	-92.3	-103.4
	Rank	2	3	1	4	5	6	3	1	2	4	5	6
2) Chronic air risks (delete factors)	Score	-118.6	-121.0	-111.1	-130.5	-156.3	-175.3	-83.6	-76.5	-79.8	-80.2	-93.1	-102.6
	Rank	2	3	1	4	5	6	4	1	2	3	5	6
3) Susceptibility of site to flooding (adjust FSL to indicate considerably greater flooding potential for LF-3C)	a) Score	-115.6	-113.1	-104.5	-118.9	-140.8	-162.1	-81.9	-72.0	-76.1	-73.8	-84.2	-95.1
	Rank	3	2	1	4	5	6	4	1	3	2	5	6
	b) Score	-124.3	-114.8	-106.3	-120.7	-142.5	-163.8	-86.9	-73.0	-77.1	-74.8	-85.2	-96.1
	Rank	4	2	1	3	5	6	5	1	3	2	4	6
Risk Weights													
1) Direct and indirect chronic air													
a) Acute and chronic weights equal (9)	Score	-116.1	-115.6	-106.9	-122.5	-144.4	-165.4	-82.2	-73.4	-77.4	-75.8	-86.3	-97.0
	Rank	3	2	1	4	5	6	4	1	3	2	5	6
b) Acute air risks weight = 9 Chronic air risks weight = 8	Score	-115.9	-115.0	-106.5	-122.4	-143.5	-164.4	-82.1	-73.1	-77.2	-75.2	-85.8	-96.4
	Rank	3	2	1	4	5	6	4	1	3	2	5	6

[1] = most preferred

TABLE I.12

Summary Results of Quantitative Sensitivity Analyses - Risks

Sensitivity Analysis		Aggregation by Discipline						Aggregation By Study Area					
		LF-3C	LF-1E	LF-9C	LF-1E/ PI-27E	LF-4N/ PI-1N	LF-4N/ PI-13N	LF-3C	LF-1E	LF-9C	LF-1E/ PI-27E	LF-4N/ PI-1N	LF-4N/ PI-13N
Base Case	Score	-115.6	-114.8	-106.2	-121.6	-143.3	-164.3	-81.9	-73.0	-77.0	-75.3	-85.7	-96.4
	Rank[1]	3	2	1	4	5	6	4	1	3	2	5	6
Risk Weights (Cont'd)													
2) Local and regional and province-wide access routes													
a) Province-wide access route factor weights increased to 10 (local and regional factor weights unchanged)	Score	-118.4	-119.1	-109.1	-125.9	-145.4	-166.4	-83.5	-75.5	-78.7	-78.1	-86.9	-97.6
	Rank	2	3	1	4	5	6	4	1	3	2	5	6
3) Transportation (less weight)													
a) Local and regional access routes decrease weight to 8	Score	-111.2	-114.6	-102.5	-121.4	-142.5	-163.6	-79.4	-72.9	-74.9	-75.2	-85.2	-95.4
	Rank	2	3	1	4	5	6	4	1	2	3	5	6
4) Transportation (greater weight) (weight increased for all factors 7 times so that LF-4N/PI-1N marginally preferred over all other siting options)	Score	-315.1	-225.0	-286.1	-231.8	-220.0	-237.0	-195.9	-135.9	-179.8	-138.3	-129.5	-137.9
	Rank	6	2	5	3	1	4	6	2	5	4	1	3
Risk Mitigation													
1) Susceptibility of site to flooding (delete factor)	Score	-116.7	-114.2	-110.9	-120.1	-147.0	-176.1	-82.5	-72.6	-79.7	-74.5	-87.8	-103.1
	Rank	3	2	1	4	5	6	4	1	3	2	5	6

TABLE I.12

Summary Results of Quantitative Sensitivity Analyses - Risks

Sensitivity Analysis		Aggregation by Discipline						Aggregation By Study Area					
		LF-3C	LF-1E	LF-9C	LF-1E/ PI-27E	LF-4N/ PI-1N	LF-4N/ PI-13N	LF-3C	LF-1E	LF-9C	LF-1E/ PI-27E	LF-4N/ PI-1N	LF-4N/ PI-13N
Base Case	Score	-115.6	-114.8	-106.2	-121.6	-143.3	-164.3	-81.9	-73.0	-77.0	-75.3	-85.7	-96.4
	Rank[1]	3	2	1	4	5	6	4	1	3	2	5	6
Risk Mitigation (Cont'd)													
2) Ground and surface water use and susceptibility to flooding (delete water use and flooding factors)	Score	-121.7	-136.1	-102.7	-141.7	-164.5	-186.0	-74.5	-71.1	-64.7	-72.9	-82.8	-92.4
	Rank	2	3	1	4	5	6	4	2	1	3	5	6
3) Acute air risks (delete direct inhalation of emissions acute factor)	Score	-114.6	-112.7	-104.6	-118.6	-139.0	-160.7	-81.3	-71.8	-76.1	-73.6	-83.2	-94.3
	Rank	3	2	1	4	5	6	4	1	3	2	5	6

TABLE I.13

Summary Results of Quantitative Sensitivity Analyses - Impacts

Sensitivity Analysis		Aggregation by Discipline						Aggregation By Study Area					
		LF-3C	LF-1E	LF-9C	LF-1E/ PI-27E	LF-4N/ PI-1N	LF-4N/ PI-13N	LF-3C	LF-1E	LF-9C	LF-1E/ PI-27E	LF-4N/ PI-1N	LF-4N/ PI-13N
Base Case	Score	-115.6	-114.8	-106.2	-121.6	-143.3	-164.3	-81.9	-73.0	-77.0	-75.3	-85.7	-96.4
	Rank[1]	3	2	1	4	5	6	4	1	3	2	5	6
Impact Prediction													
1) Less conservative approach - noise impacts - access roads (exclude residents who would be affected by sound levels in excess of 55dBA in the future without OWMC's additional traffic)	Score	-115.6	-115.0	-106.3	-121.8	-143.2	-164.2	-81.9	-73.3	-77.1	-75.7	-85.5	-96.2
	Rank	3	2	1	4	5	6	4	1	3	2	5	6
2) Larger negative property value and out-migration impacts	Score	-115.2	-114.8	-105.8	-121.2	-142.5	-164.3	-81.9	-73.0	-77.0	-75.3	-85.6	-96.4
	Rank	3	2	1	4	5	6	4	1	3	2	5	6
Impact Weights													
1) Industrial designation (greater weight) (treat on-site social and biology impacts as equal for Niagara Falls siting options and increase ranking for planned and proposed land use (site) to 10)	Score	-116.8	-115.9	-107.5	-120.3	-144.5	-165.4	-83.0	-74.0	-78.1	-73.5	-86.7	-97.3
	Rank	3	2	1	4	5	6	4	2	3	1	5	6
2) Industrial designation (deleted for PI-27E) (lower weight)	Score	-115.6	-114.8	-106.2	-124.1	-143.3	-164.3	-81.9	-73.0	-77.0	-77.8	-85.7	-96.4
	Rank	3	2	1	4	5	6	4	1	2	3	5	6
3) Greater weight - displacement of farmland and farms (on-site and partial)	Score	-117.0	-116.1	-106.6	-122.3	-144.5	-166.1	-83.8	-74.7	-77.7	-76.3	-87.2	-98.7
	Rank	3	2	1	4	5	6	4	1	3	2	5	6

---

[1] = most preferred

TABLE I.13

Summary Results of Quantitative Sensitivity Analyses - Impacts

Sensitivity Analysis		Aggregation by Discipline						Aggregation By Study Area					
		LF-3C	LF-1E	LF-9C	LF-1E/ PI-27E	LF-4N/ PI-1N	LF-4N/ PI-13N	LF-3C	LF-1E	LF-9C	LF-1E/ PI-27E	LF-4N/ PI-1N	LF-4N/ PI-13N
Base Case	Score	-115.6	-114.8	-106.2	-121.6	-143.3	-164.3	-81.9	-73.0	-77.0	-75.3	-85.7	-96.4
	Rank[1]	3	2	1	4	5	6	4	1	3	2	5	6
Impact Weights (Cont'd)													
4) Less weight - air impacts (delete factors)	Score	-115.6	-114.5	-106.2	-121.6	-143.3	-164.3	-82.6	-73.2	-77.6	-75.5	-86.1	-97.0
	Rank	3	2	1	4	5	6	4	1	3	2	5	6
5) Greater weight - natural environmental factors - site and site vicinity	Score	-137.4	-135.6	-118.4	-152.0	-154.0	-179.4	-87.8	-79.0	-80.0	-83.0	-88.3	-100.0
	Rank	3	2	1	4	5	6	4	1	2	3	5	6
6) Business, agriculture, tourism components of economic base													
a) Tourism = Economic Base	Score	-110.0	-121.6	-104.6	-129.6	-137.3	-155.9	-81.3	-73.7	-76.9	-76.2	-85.0	-95.4
	Rank	2	3	1	4	5	6	4	1	3	2	5	6
b) Agriculture = Economic Base	Score	-119.2	-114.4	-109.8	-120.0	-143.7	-164.3	-82.3	-72.9	-77.4	-76.2	-85.7	-96.4
	Rank	3	2	1	4	5	6	4	1	3	2	5	6
c) All components equal	Score	-114.4	-122.0	-107.4	-129.6	-139.7	-158.3	-81.8	-73.8	-77.2	-76.2	-85.3	-95.7
	Rank	2	3	1	4	5	6	4	1	3	2	5	6
7) Alternative positive and negative economic base factor weights	Score	-113.9	-114.5	-104.4	-122.6	-141.0	-162.4	-81.9	-72.6	-76.8	-76.2	-85.6	-96.3
	Rank	2	3	1	4	5	6	4	1	3	2	5	6
8) Reduced weights - community and regional and access road impacts (reduce by one level)	Score	-113.1	-113.6	-105.5	-120.0	-138.5	-158.7	-78.2	-71.6	-74.2	-73.9	-82.3	-92.8
	Rank	2	3	1	4	5	6	4	1	3	2	5	6

TABLE I.13

Summary Results of Quantitative Sensitivity Analyses - Impacts

Sensitivity Analysis		Aggregation by Discipline						Aggregation By Study Area					
		LF-3C	LF-1E	LF-9C	LF-1E/ PI-27E	LF-4N/ PI-1N	LF-4N/ PI-13N	LF-3C	LF-1E	LF-9C	LF-1E/ PI-27E	LF-4N/ PI-1N	LF-4N/ PI-13N
Base Case	Score	-115.6	-114.8	-106.2	-121.6	-143.3	-164.3	-81.9	-73.0	-77.0	-75.3	-85.7	-96.4
	Rank[1]	3	2	1	4	5	6	4	1	3	2	5	6
Impacts - Mitigation and Compensation													
1) Assume municipal services and municipal financial impacts mitigable through compensation	Score	-120.3	-112.2	-110.4	-117.4	-132.0	-150.8	-85.1	-75.1	-80.0	-77.3	-87.2	-98.0
	Rank	4	2	1	3	5	6	4	1	3	2	5	6
2) Assume on-site impacts mitigable - businesses, residents, farms, natural features, land uses	Score	-113.8	-109.3	-105.4	-115.3	-141.7	-163.2	-81.8	-70.1	-74.8	-67.6	-90.1	-100.1
	Rank	3	2	1	4	5	6	4	2	3	1	5	6
3) Assume impacts on adjacent residents, community and recreation features and farms are mitigable through property buyout program	Score	-116.1	-115.5	-105.8	-120.6	-142.3	-161.7	-81.7	-72.8	-75.4	-73.3	-84.4	-94.1
	Rank	3	2	1	4	5	6	4	1	3	2	5	6
4) Assume site vicinity noise impacts largely mitigable (design and operations changes)	Score	-115.6	-114.8	-106.2	-121.6	-143.0	-164.2	-82.0	-73.0	-77.0	-75.4	-85.4	-96.3
	Rank	3	2	1	4	5	6	4	1	3	2	5	6
5) Assume property value impacts mitigable (property value protection program)	Score	-115.2	-100.0	-90.6	-98.8	-136.9	-164.3	-81.9	-71.3	-75.3	-72.8	-85.0	-96.4
	Rank	4	3	1	2	5	6	4	1	3	2	5	6
6) Assume natural environmental site vicinity impacts mitigable (design and operations, habitat creation and enhancement)	Score	-117.1	-116.1	-109.2	-124.2	-145.8	-166.1	-83.8	-74.1	-79.3	-76.3	-88.7	-99.2
	Rank	3	2	1	4	5	6	4	1	3	2	5	6

TABLE I.13

Summary Results of Quantitative Sensitivity Analyses - Impacts

Sensitivity Analysis		Aggregation by Discipline						Aggregation By Study Area					
		LF-3C	LF-1E	LF-9C	LF-1E/ PI-27E	LF-4N/ PI-1N	LF-4N/ PI-13N	LF-3C	LF-1E	LF-9C	LF-1E/ PI-27E	LF-4N/ PI-1N	LF-4N/ PI-13N
Base Case	Score Rank[1]	-115.6 3	-114.8 2	-106.2 1	-121.6 4	-143.3 5	-164.3 6	-81.9 4	-73.0 1	-77.0 3	-75.3 2	-85.7 5	-96.4 6
Impacts - Mitigation and Compensation (Cont'd)													
7) Assume entire site assessed as industrial land	Score Rank	-115.3 3	-112.9 2	-107.2 1	-121.8 4	-143.1 5	-164.1 6	-81.9 4	-72.7 1	-77.1 3	-75.3 2	-85.7 5	-96.0 6

TABLE I.14

Summary Results of Quantitative Sensitivity Analyses - Future Conditions, Study Area Boundaries and Risks/Impacts/Costs

Sensitivity Analysis		Aggregation by Discipline						Aggregation By Study Area					
		LF-3C	LF-1E	LF-9C	LF-1E/ PI-27E	LF-4N/ PI-1N	LF-4N/ PI-13N	LF-3C	LF-1E	LF-9C	LF-1E/ PI-27E	LF-4N/ PI-1N	LF-4N/ PI-13N
Base Case	Score	-115.6	-114.8	-106.2	-121.6	-143.3	-164.3	-81.9	-73.0	-77.0	-75.3	-85.7	-96.4
	Rank[1]	3	2	1	4	5	6	4	1	3	2	5	6
Future Conditions and Study Area Boundaries													
1) Definition of local and regional roads - Niagara Falls	Score	-108.4	-135.8	-101.1	-142.6	-143.3	-164.3	-77.8	-85.0	-74.1	-87.3	-85.7	-96.4
	Rank	2	3	1	4	5	6	3	2	1	5	4	6
2) Transportation - indirect risks (delete receptors data for local an regional roads)	Score	-115.6	-116.3	-104.8	-122.0	-145.5	-166.5	-81.9	-73.7	-76.2	-75.4	-87.1	-97.8
	Rank	2	3	1	4	5	6	4	1	3	2	5	6
Risks/Impacts/Costs													
1) Greater weight to risks													
a) LF-3C and LF-9C marginally preferred over all other options (risks x 7.4)	Score							-338.9	-354.3	-354.2	-358.7	-391.5	-449.7
	Rank							1	3	2	4	5	6

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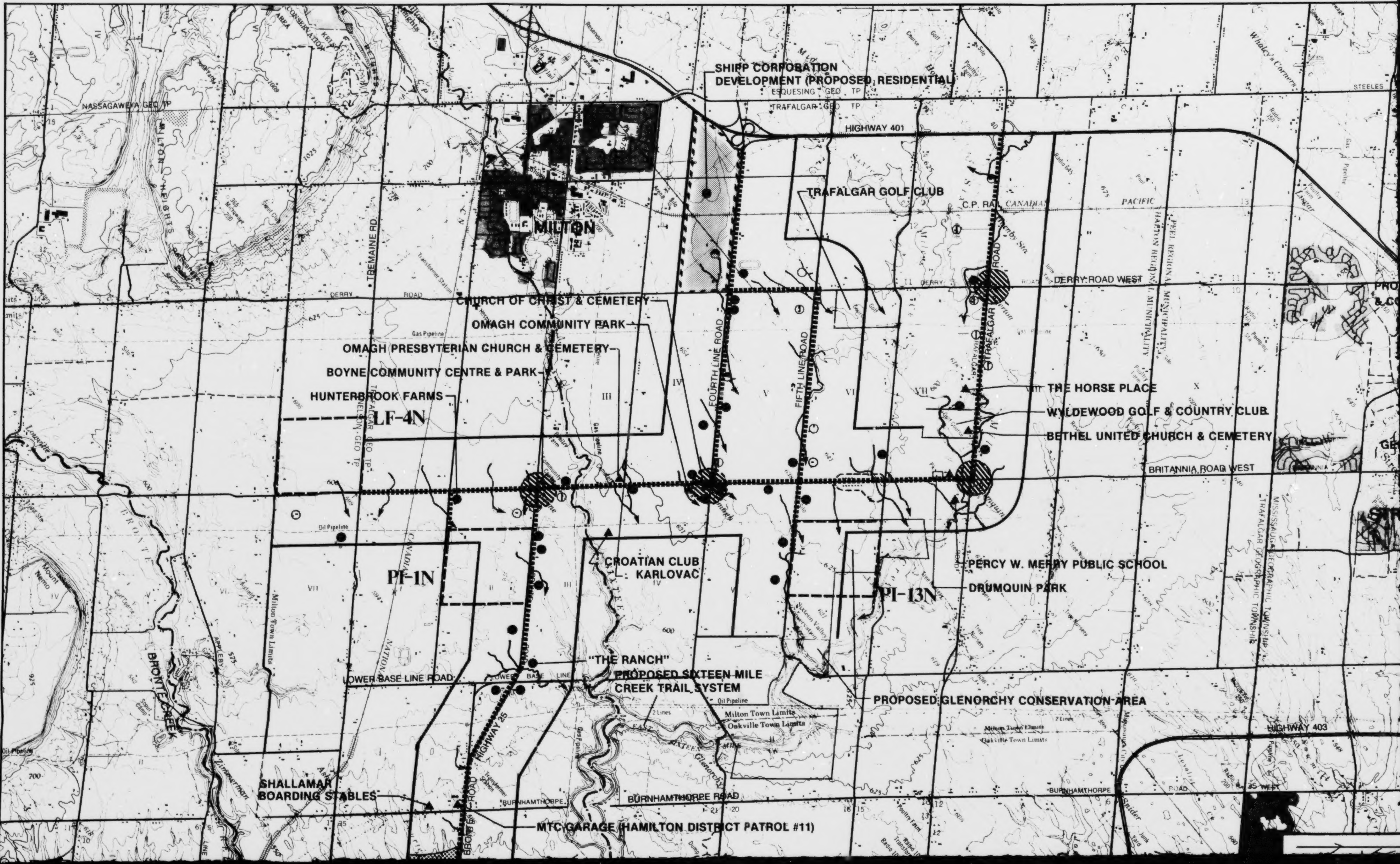
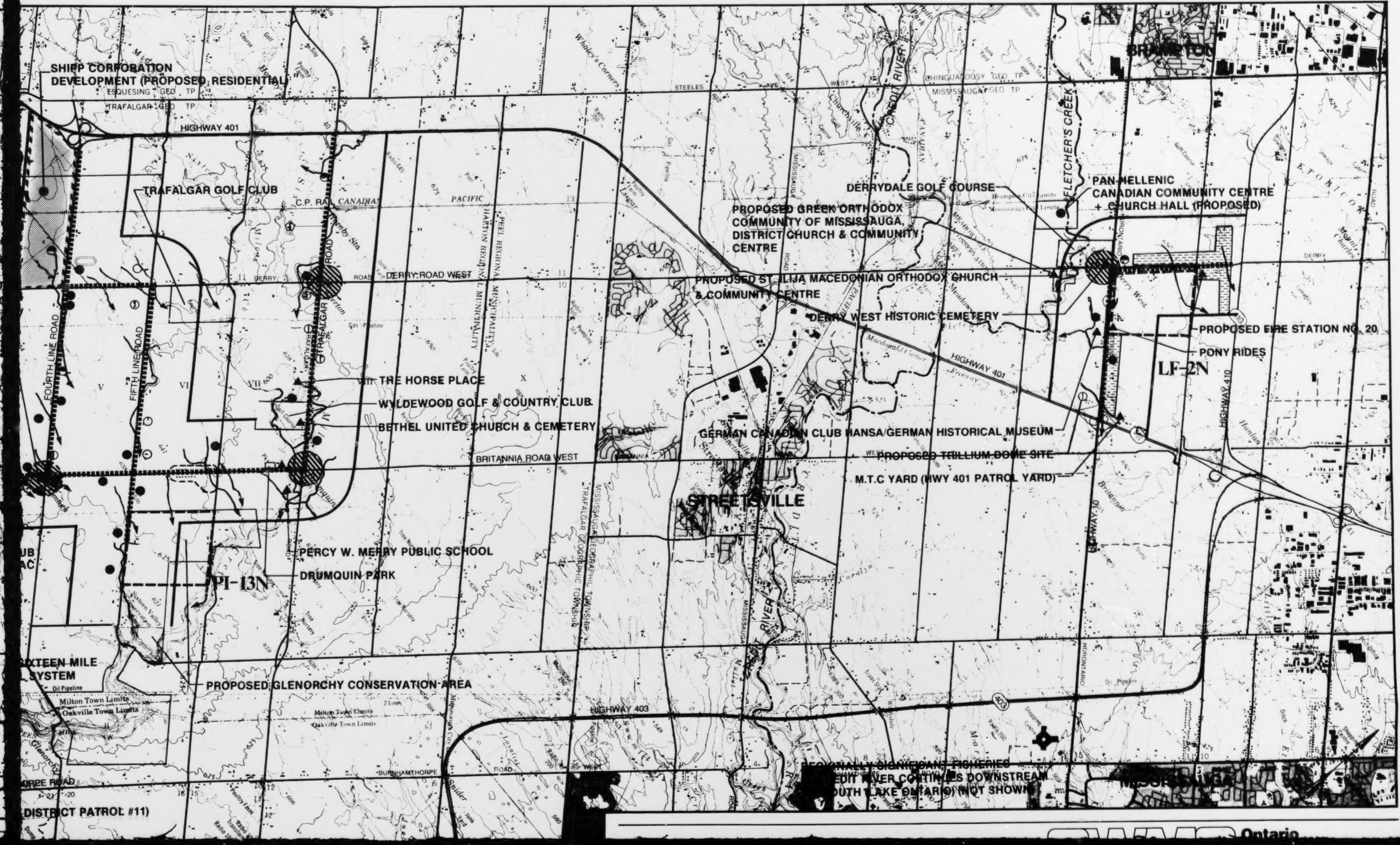
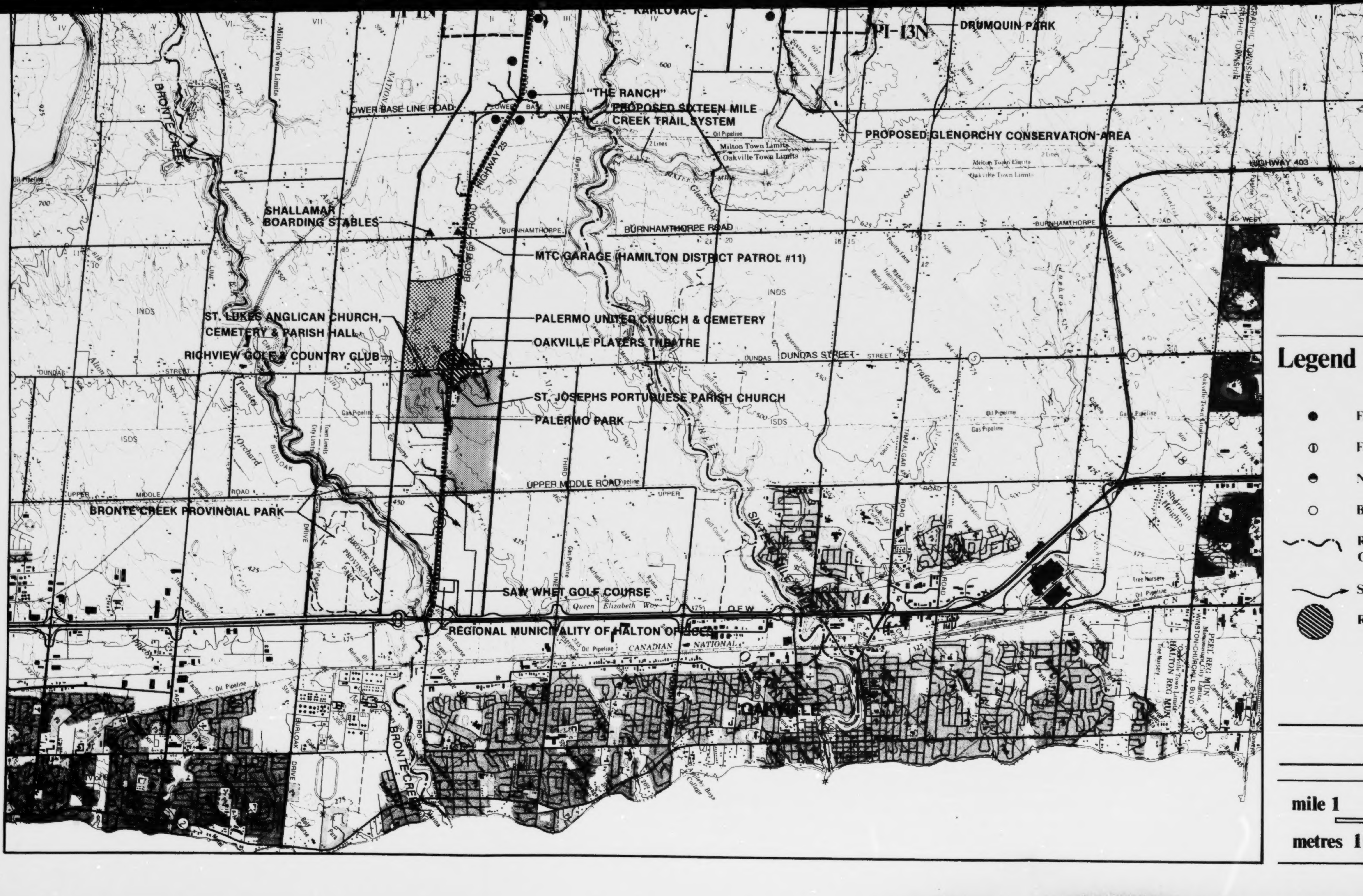
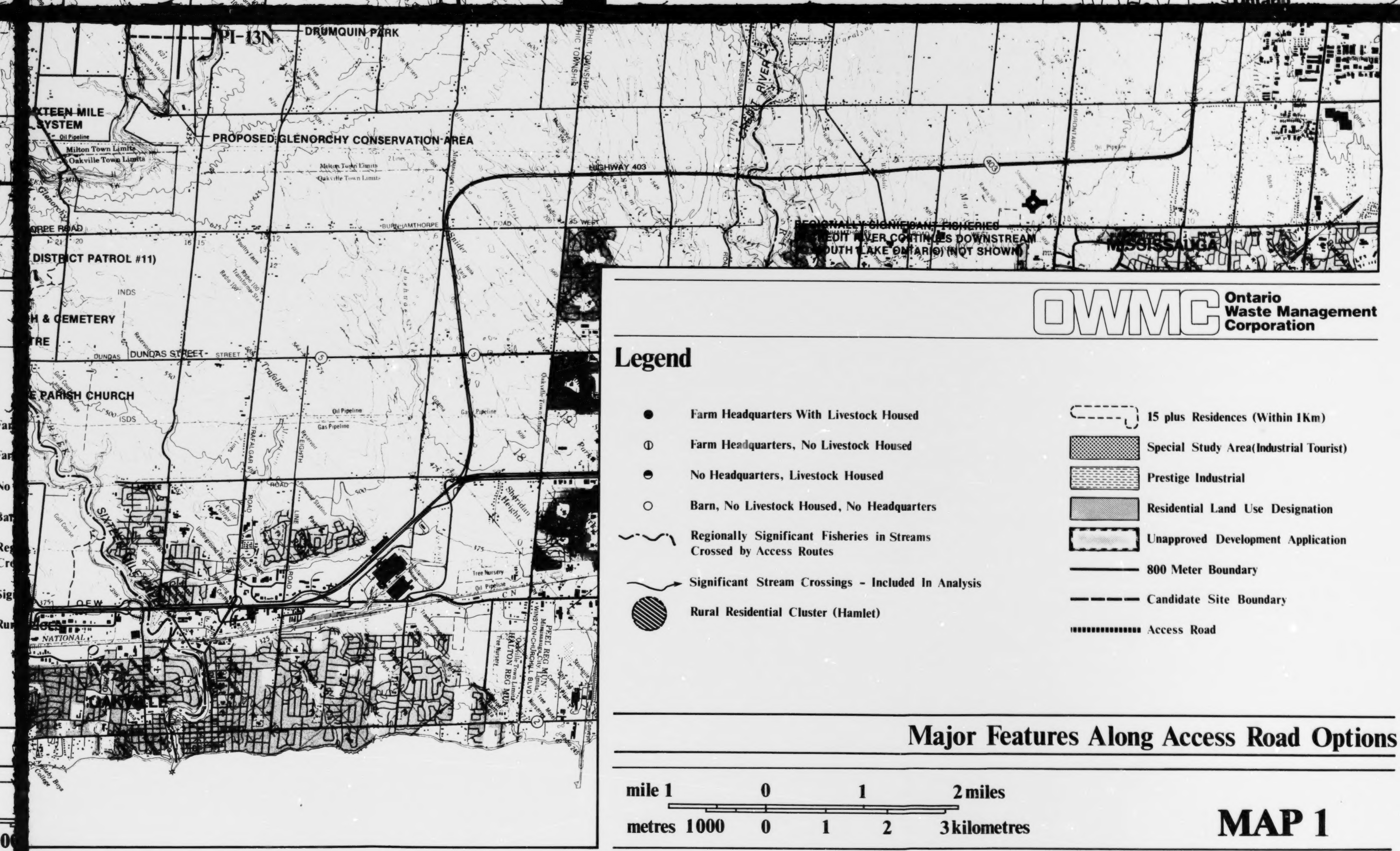
[1] = most preferred


SHIPP CORPORATION DEVELOPMENT (PROPOSED RESIDENTIAL)
ESQUESING GEO TP
TRAFALGAR GEO TP
HIGHWAY 401
NASSAGAWEYA GEO TP
MILTON HEIGHTS
MILTON
TRAFALGAR GOLF CLUB
C.P. RAIL
CANADIAN PACIFIC
TREMAINE RD.
DERRY ROAD
DERRY ROAD WEST
TRAFALGAR ROAD
CHURCH OF CHRIST & CEMETERY
OMAGH COMMUNITY PARK
OMAGH PRESBYTERIAN CHURCH & CEMETERY
BOYNE COMMUNITY CENTRE & PARK
HUNTERBROOK FARMS
LF-4N
FOURTH LINE ROAD
FIFTH LINE ROAD
HALTON REGIONAL MUNICIPALITY
PEEL REGIONAL MUNICIPALITY
THE HORSE PLACE
WYLDEWOOD GOLF & COUNTRY CLUB
BETHEL UNITED CHURCH & CEMETERY
BRITANNIA ROAD WEST
NELSON GEO TP
TRAFALGAR GEO TP
Gas Pipeline
Oil Pipeline
CROATIAN CLUB KARLOVAC
PI-1N
PI-13N
PERCY W. MERRY PUBLIC SCHOOL
DRUMQUIN PARK
MISSISSAUGA GEOGRAPHIC TOWNSHIP
Milton Town Limits
Oakville Town Limits
BRONTE CREEK
"THE RANCH"
LOWER BASE LINE ROAD
PROPOSED SIXTEEN MILE CREEK TRAIL SYSTEM
PROPOSED GLENORCHY CONSERVATION AREA
HIGHWAY 403
HIGHWAY 25
SHALLAMAR BOARDING STABLES
BURNHAMTHORPE ROAD
MTC GARAGE (HAMILTON DISTRICT PATROL #11)
STEELES
Whaley's Corners


SHIPP CORPORATION DEVELOPMENT (PROPOSED RESIDENTIAL)
ESQUESING GEO TP
TRAFALGAR GEO TP
HIGHWAY 401
TRAFALGAR GOLF CLUB
C.P. RAIL CANADIAN PACIFIC
DERRY ROAD WEST
FOURTH LINE ROAD
FIFTH LINE ROAD
TRAFALGAR ROAD
THE HORSE PLACE
WYLDEWOOD GOLF & COUNTRY CLUB
BETHEL UNITED CHURCH & CEMETERY
BRITANNIA ROAD WEST
PERCY W. MERRY PUBLIC SCHOOL
DRUMQUIN PARK
PI-13N
SIXTEEN MILE
SYSTEM
PROPOSED GLENORCHY CONSERVATION AREA
Milton Town Limits
Oakville Town Limits
HIGHWAY 403
BURNHAMTHORPE ROAD
(DISTRICT PATROL #11)
PEEL REGIONAL MUNICIPALITY
HALTON REGIONAL MUNICIPALITY
MISSISSAUGA GEOGRAPHIC TOWNSHIP
TRAFALGAR GEOGRAPHIC TOWNSHIP
STEELES AVE WEST
CHINGUACOUSY GEO TP
MISSISSAUGA GEO TP
BRAMPTON
CREDIT RIVER
FLETCHER'S CREEK
DERRYDALE GOLF COURSE
PAN-HELLENIC CANADIAN COMMUNITY CENTRE + CHURCH HALL (PROPOSED)
PROPOSED GREEK ORTHODOX COMMUNITY OF MISSISSAUGA, DISTRICT CHURCH & COMMUNITY CENTRE
PROPOSED ST. ILIJA MACEDONIAN ORTHODOX CHURCH & COMMUNITY CENTRE
DERRY WEST HISTORIC CEMETERY
PROPOSED FIRE STATION NO. 20
PONY RIDES
LF-2N
HIGHWAY 410
HIGHWAY 10
Macdonald Cartier Freeway
GERMAN CANADIAN CLUB HANSA/GERMAN HISTORICAL MUSEUM
PROPOSED TRILLIUM DOME SITE
M.T.C YARD (HWY 401 PATROL YARD)
STREETSVILLE
HURONTARIO
ETOBICOKE
REGIONALLY SIGNIFICANT FISHERIES
CREDIT RIVER CONTINUES DOWNSTREAM
TO SOUTH LAKE ONTARIO (NOT SHOWN)
MISSISSAUGA
Ontario


KARLOVAC
DRUMQUIN PARK
"THE RANCH"
PROPOSED SIXTEEN MILE CREEK TRAIL SYSTEM
PROPOSED GLENORCHY CONSERVATION AREA
LOWER BASE LINE ROAD
SHALLAMAR BOARDING STABLES
MTC GARAGE (HAMILTON DISTRICT PATROL #11)
ST. LUKES ANGLICAN CHURCH, CEMETERY & PARISH HALL
PALERMO UNITED CHURCH & CEMETERY
OAKVILLE PLAYERS THEATRE
RICHVIEW GOLF & COUNTRY CLUB
ST. JOSEPHS PORTUGUESE PARISH CHURCH
PALERMO PARK
BRONTE CREEK PROVINCIAL PARK
SAW WHET GOLF COURSE
REGIONAL MUNICIPALITY OF HALTON OFFICES
BRONTE CREEK
HIGHWAY 25
HIGHWAY 403
BURNHAMTHORPE ROAD
DUNDAS STREET
UPPER MIDDLE ROAD
Queen Elizabeth Way
CANADIAN NATIONAL
Milton Town Limits
Oakville Town Limits
OAKVILLE
PI-13N
Legend
mile 1
metres 1


PI-13N
DRUMQUIN PARK
SIXTEEN MILE SYSTEM
Oil Pipeline
Milton Town Limits
Oakville Town Limits
PROPOSED GLENORCHY CONSERVATION AREA
HIGHWAY 403
403
BURNHAMTHORPE ROAD
DISTRICT PATROL #11
CEMETERY
DUNDAS STREET
5
Oil Pipeline
Gas Pipeline
TRAFALGAR ROAD
EIGHTH LINE
Sheridan Heights
Tree Nursery
CN
QEW
NATIONAL
OAKVILLE
PEEL REG MUN
HALTON REG MUN
WINSTON-CHURCHILL BLVD
Oakville Town Limits
2
CREDIT RIVER
HURONTARIO
REGIONALLY SIGNIFICANT FISHERIES
CREDIT RIVER CONTINUES DOWNSTREAM
TO MOUTH (LAKE ONTARIO) (NOT SHOWN)
MISSISSAUGA

OWMC Ontario Waste Management Corporation

Legend

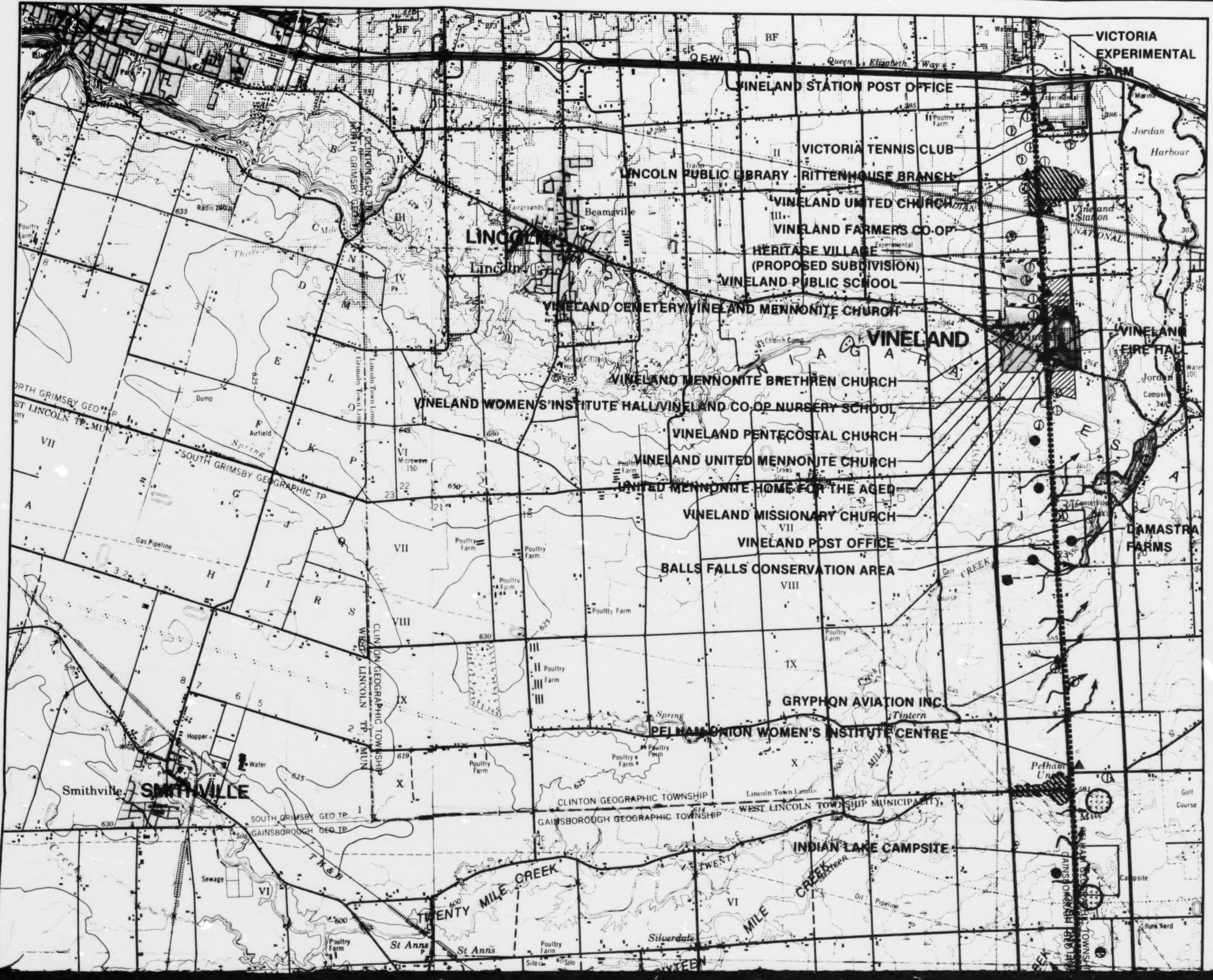
- ● Farm Headquarters With Livestock Housed
- ◐ Farm Headquarters, No Livestock Housed
- ◒ No Headquarters, Livestock Housed
- ○ Barn, No Livestock Housed, No Headquarters
- Regionally Significant Fisheries in Streams Crossed by Access Routes
- Significant Stream Crossings - Included In Analysis
- ▨ Rural Residential Cluster (Hamlet)
- 15 plus Residences (Within 1Km)
- ▩ Special Study Area(Industrial Tourist)
- ▤ Prestige Industrial
- ▒ Residential Land Use Designation
- ▨ Unapproved Development Application
- 800 Meter Boundary
- Candidate Site Boundary
- Access Road

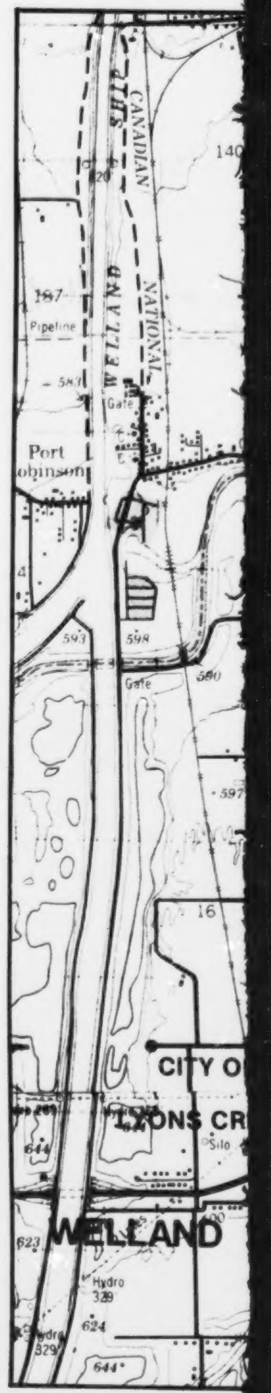
Major Features Along Access Road Options

mile 1 0 1 2 miles

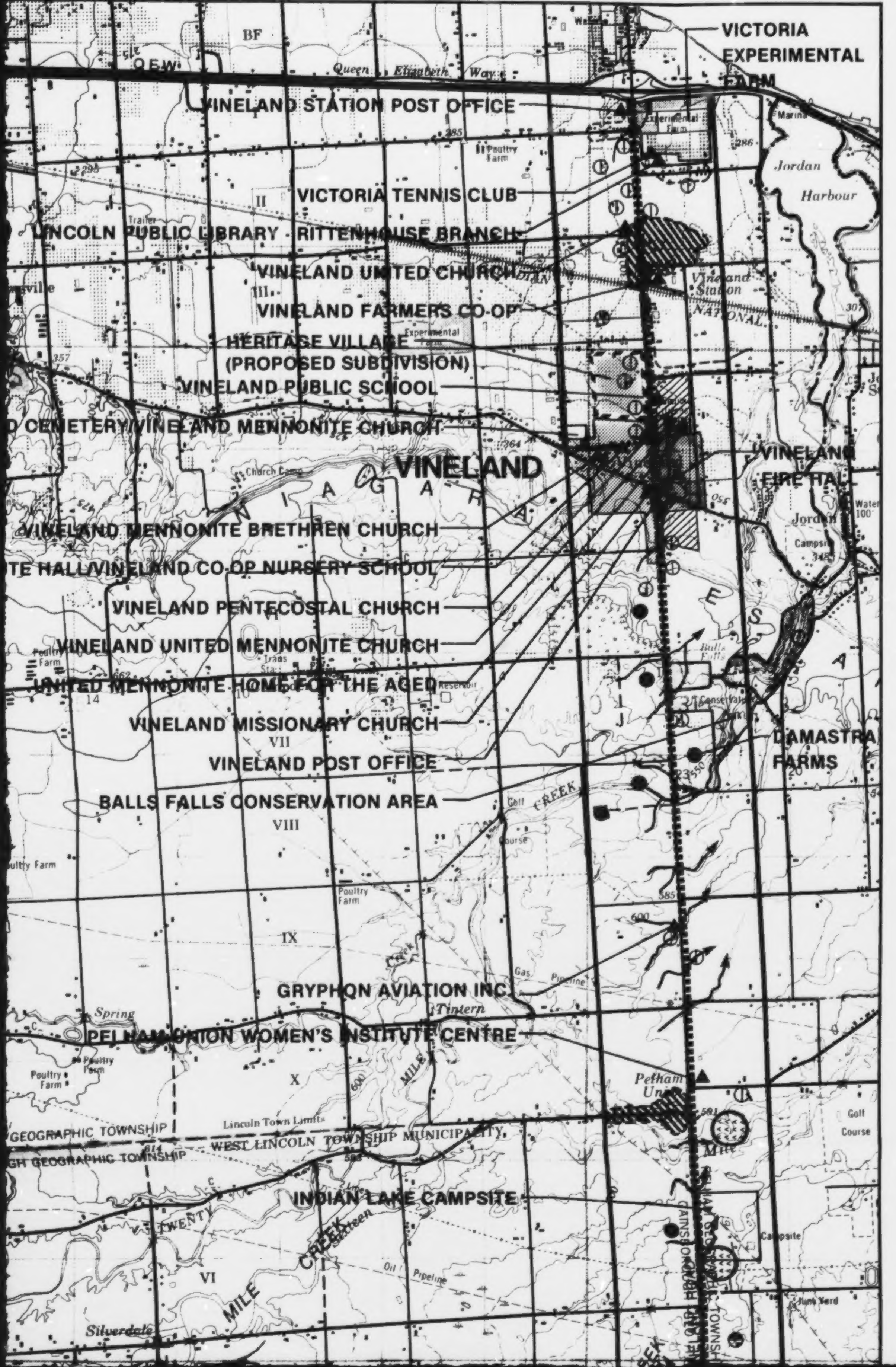
metres 1000 0 1 2 3 kilometres

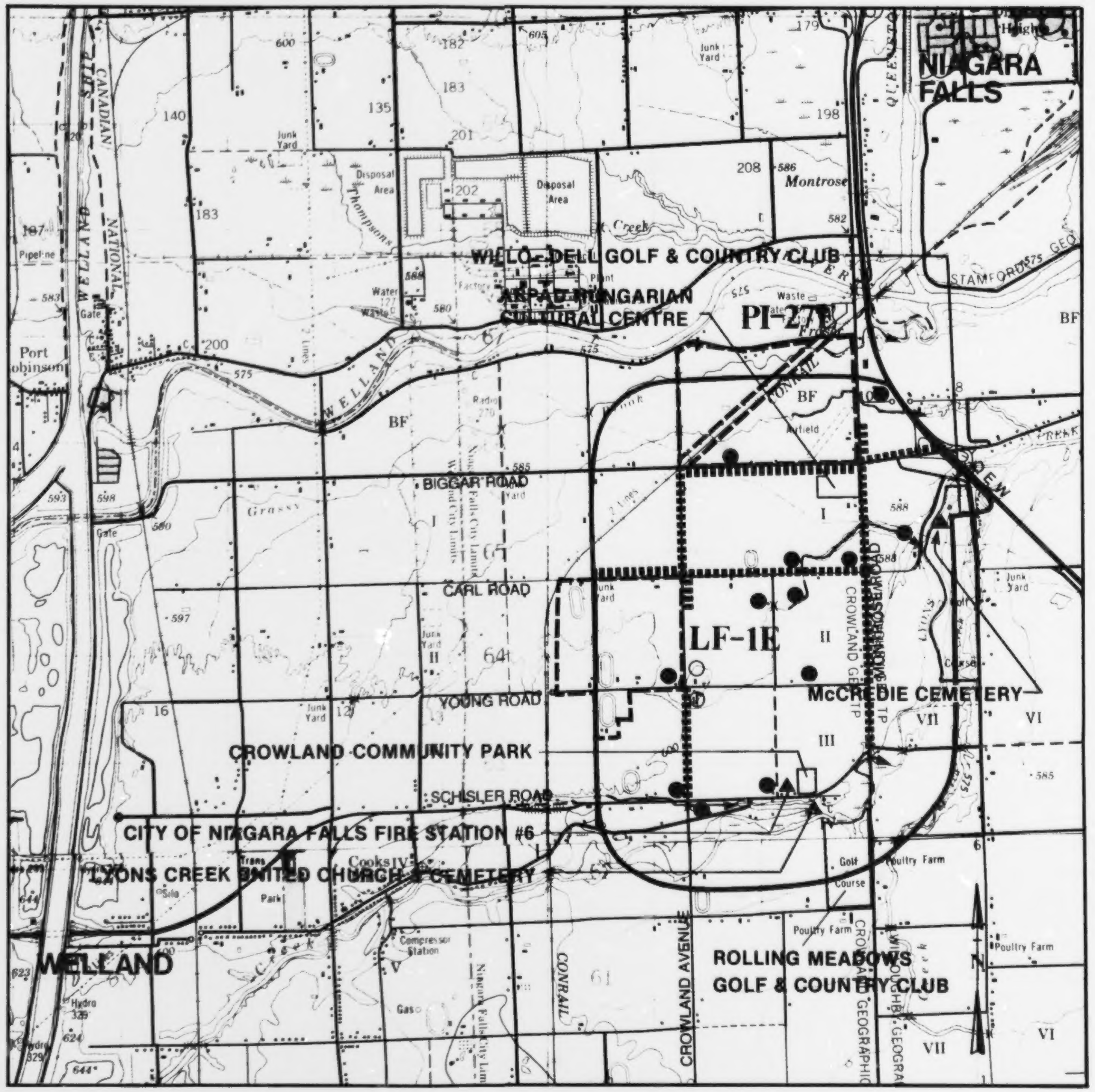
MAP 1

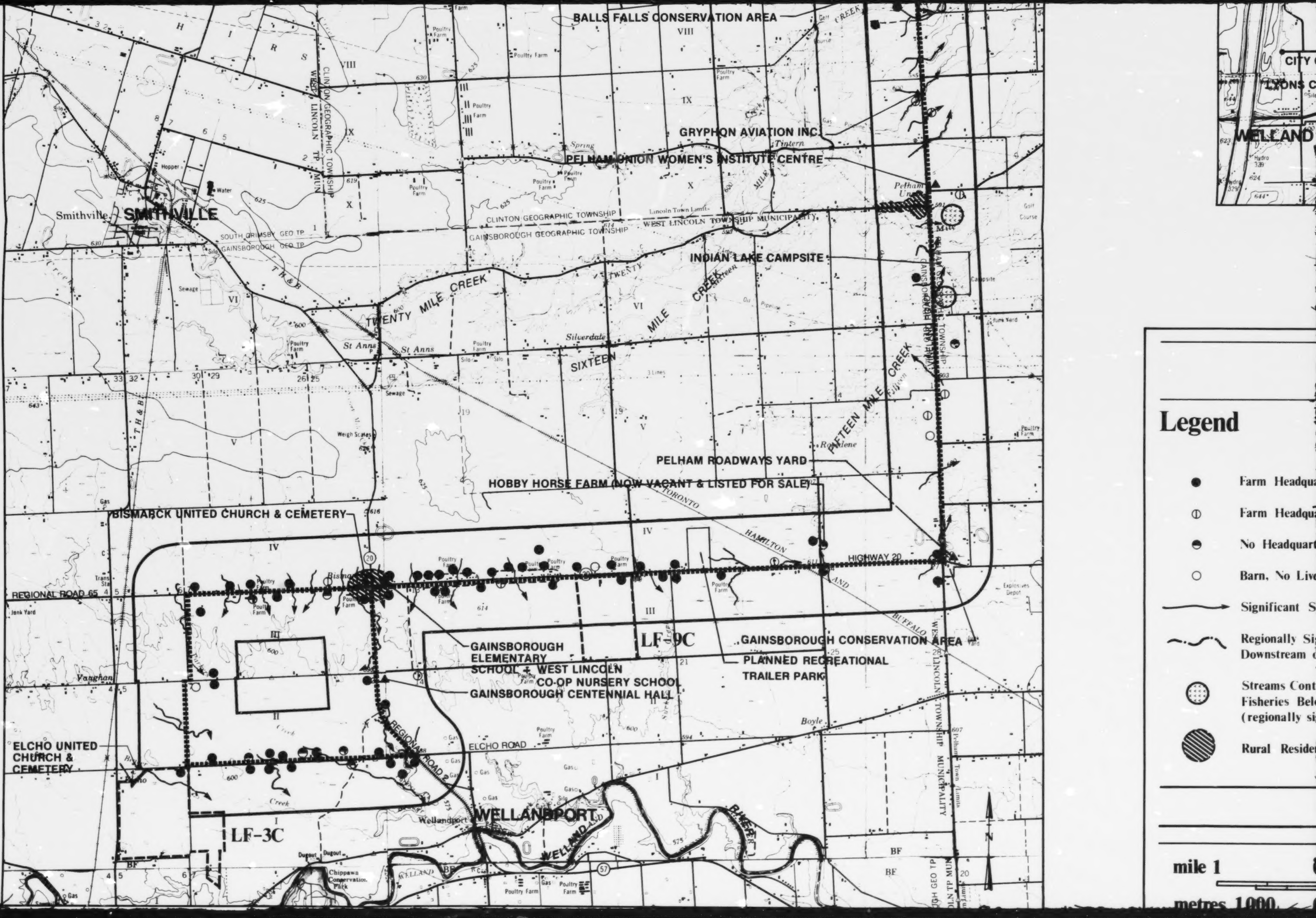

VICTORIA EXPERIMENTAL FARM
VINELAND STATION POST OFFICE
VICTORIA TENNIS CLUB
LINCOLN PUBLIC LIBRARY - RITTENHOUSE BRANCH
VINELAND UNITED CHURCH
VINELAND FARMERS CO-OP
HERITAGE VILLAGE (PROPOSED SUBDIVISION)
VINELAND PUBLIC SCHOOL
VINELAND CEMETERY/VINELAND MENNONITE CHURCH
VINELAND
VINELAND FIRE HALL
VINELAND MENNONITE BRETHREN CHURCH
VINELAND WOMEN'S INSTITUTE HALL/VINELAND CO-OP NURSERY SCHOOL
VINELAND PENTECOSTAL CHURCH
VINELAND UNITED MENNONITE CHURCH
UNITED MENNONITE HOME FOR THE AGED
VINELAND MISSIONARY CHURCH
VINELAND POST OFFICE
DAMASTRA FARMS
BALLS FALLS CONSERVATION AREA
GRYPHON AVIATION INC.
PELHAM UNION WOMEN'S INSTITUTE CENTRE
INDIAN LAKE CAMPSITE
LINCOLN
Lincoln
Beamsville
SMITHVILLE
Smithville
Jordan Harbour
Jordan
Queen Elizabeth Way
QEW
NIAGARA ESCARPMENT
TWENTY MILE CREEK
CLINTON GEOGRAPHIC TOWNSHIP
GAINSBOROUGH GEOGRAPHIC TOWNSHIP
WEST LINCOLN TOWNSHIP MUNICIPALITY
SOUTH GRIMSBY GEOGRAPHIC TP
NORTH GRIMSBY GEO TP
St Anns
Silverdale
Tintern
Hopper
Poultry Farm
Golf Course
Campsite
Gas Pipeline
Oil Pipeline

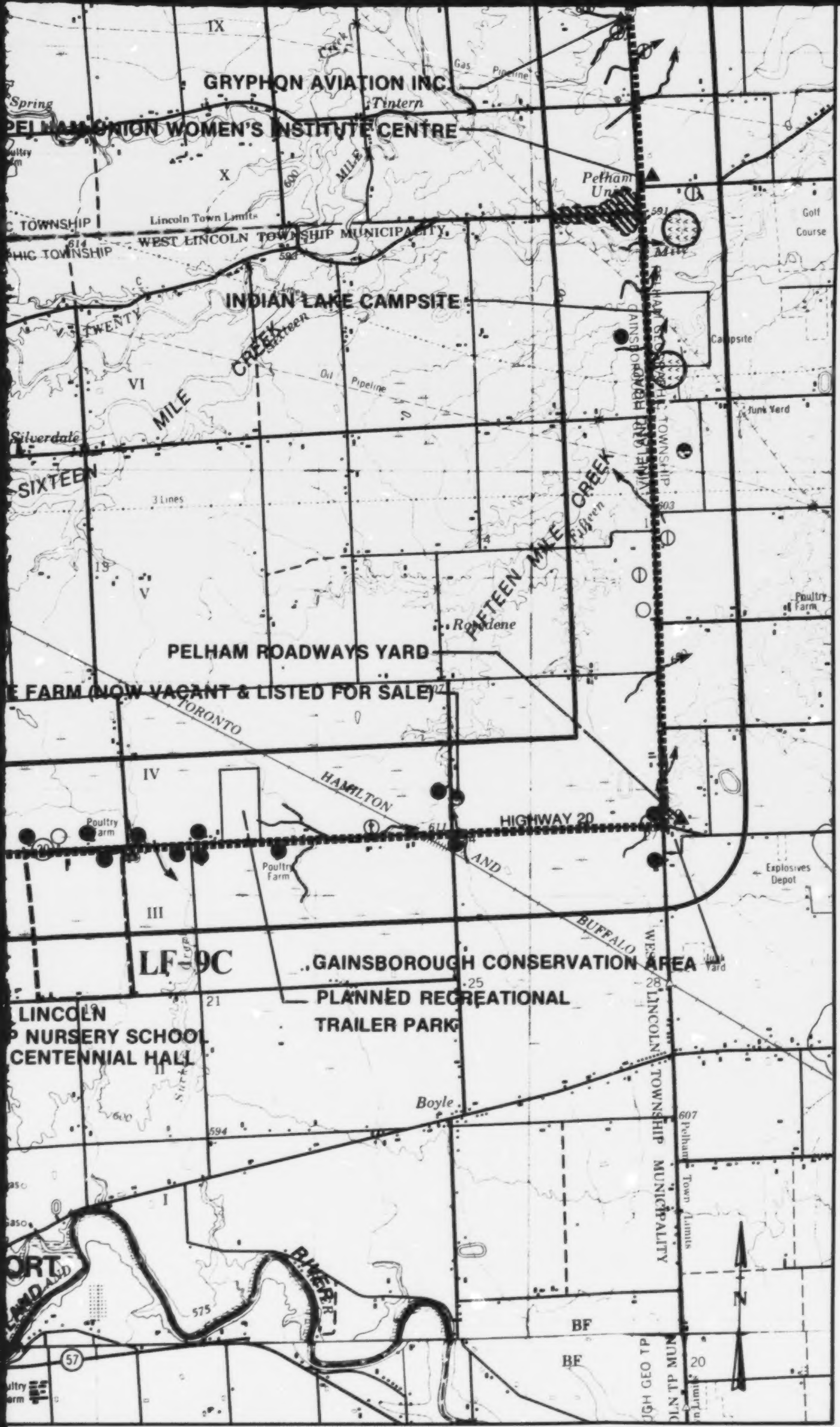

CITY OF
LYONS CR
WELLAND
Port Robinson
WELLAND SHIP CANAL

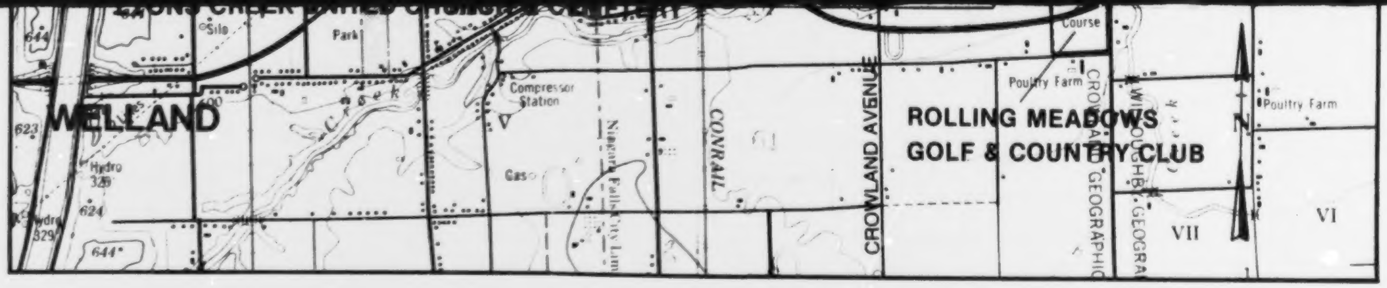
BALLS FALLS CONSERVATION AREA


VICTORIA EXPERIMENTAL FARM
VINELAND STATION POST OFFICE
VICTORIA TENNIS CLUB
LINCOLN PUBLIC LIBRARY - RITTENHOUSE BRANCH
VINELAND UNITED CHURCH
VINELAND FARMERS CO-OP
HERITAGE VILLAGE (PROPOSED SUBDIVISION)
VINELAND PUBLIC SCHOOL
CEMETERY/VINELAND MENNONITE CHURCH
VINELAND
VINELAND FIRE HALL
VINELAND MENNONITE BRETHREN CHURCH
HALL/VINELAND CO-OP NURSERY SCHOOL
VINELAND PENTECOSTAL CHURCH
VINELAND UNITED MENNONITE CHURCH
UNITED MENNONITE HOME FOR THE AGED
VINELAND MISSIONARY CHURCH
DAMASTRA FARMS
VINELAND POST OFFICE
BALLS FALLS CONSERVATION AREA
GRYPHON AVIATION INC.
PELHAM UNION WOMEN'S INSTITUTE CENTRE
INDIAN LAKE CAMPSITE
Queen Elizabeth Way
Jordan Harbour
NIAGARA
ESCARPMENT
Pelham Union
TWENTY MILE CREEK
Silverdale
Spring
Tintern
GEOGRAPHIC TOWNSHIP
WEST LINCOLN TOWNSHIP MUNICIPALITY
Lincoln Town Limit


NIAGARA FALLS
Montrose
WILLO-DELL GOLF & COUNTRY CLUB
ARPAD HUNGARIAN CULTURAL CENTRE
PI-27E
WELLAND
CANADIAN NATIONAL
BIGGAR ROAD
CARL ROAD
LF-1E
YOUNG ROAD
McCREDIE CEMETERY
CROWLAND COMMUNITY PARK
SCHISLER ROAD
CITY OF NIAGARA FALLS FIRE STATION #6
LYONS CREEK UNITED CHURCH & CEMETERY
Port Robinson
Cooks Mills
ROLLING MEADOWS GOLF & COUNTRY CLUB
CROWLAND AVENUE
CONRAIL
CROWLAND GEOGRAPHIC
WILLOUGHBY GEOGRAPHIC
N


BALLS FALLS CONSERVATION AREA
GRYPHON AVIATION INC.
PELHAM UNION WOMEN'S INSTITUTE CENTRE
INDIAN LAKE CAMPSITE
SMITHVILLE
Smithville
CLINTON GEOGRAPHIC TOWNSHIP
GAINSBOROUGH GEOGRAPHIC TOWNSHIP
WEST LINCOLN TOWNSHIP MUNICIPALITY
SOUTH GRIMSBY GEO TP
GAINSBOROUGH GEO TP
WEST LINCOLN TP MUN
CLINTON GEOGRAPHIC TOWNSHIP
TWENTY MILE CREEK
SIXTEEN MILE CREEK
FIFTEEN MILE CREEK
St Anns
Silverdale
Tintern
Pelham Union
PELHAM ROADWAYS YARD
HOBBY HORSE FARM (NOW VACANT & LISTED FOR SALE)
BISMARCK UNITED CHURCH & CEMETERY
TORONTO HAMILTON AND BUFFALO
HIGHWAY 20
REGIONAL ROAD 65
GAINSBOROUGH ELEMENTARY SCHOOL + WEST LINCOLN CO-OP NURSERY SCHOOL
GAINSBOROUGH CENTENNIAL HALL
LF-9C
GAINSBOROUGH CONSERVATION AREA
PLANNED RECREATIONAL TRAILER PARK
ELCHO UNITED CHURCH & CEMETERY
ELCHO ROAD
REGIONAL ROAD 2
WELLANDPORT
Wellandport
WELLAND RIVER
LF-3C
Chippawa Conservation Park
Vaughan
Boyle
Rosedene
Explosives Depot
Junk Yard
CITY
LYONS C
WELLAND
N
Legend
● Farm Headqua
⦶ Farm Headqua
◓ No Headquart
○ Barn, No Live
→ Significant S
Regionally Si Downstream
Streams Cont Fisheries Bel (regionally si
▨ Rural Reside
mile 1
metres 1000


GRYPHON AVIATION INC.
PELHAM UNION WOMEN'S INSTITUTE CENTRE
INDIAN LAKE CAMPSITE
TWENTY MILE CREEK
FIFTEEN MILE CREEK
PELHAM ROADWAYS YARD
FARM (NOW VACANT & LISTED FOR SALE)
TORONTO HAMILTON AND BUFFALO
HIGHWAY 20
LF-9C
GAINSBOROUGH CONSERVATION AREA
PLANNED RECREATIONAL TRAILER PARK
LINCOLN
NURSERY SCHOOL
CENTENNIAL HALL
WEST LINCOLN TOWNSHIP MUNICIPALITY
Pelham Union
Silverdale
Rosedene
Boyle
Tintern
Spring
Golf Course
Campsite
Junk Yard
Explosives Depot
Poultry Farm
Lincoln Town Limits
Pipeline
Oil Pipeline
SIXTEEN
BF
N


WELLAND
ROLLING MEADOWS GOLF & COUNTRY CLUB
CROWLAND AVENUE
CONRAIL
Compressor Station
Poultry Farm
Gas
Hydro
Park
Silo
VII
VI
N

OWMC Ontario Waste Management Corporation

Legend

- ● Farm Headquarters With Livestock Housed
- ⦶ Farm Headquarters, No Livestock Housed
- ◒ No Headquarters, Livestock Housed
- ○ Barn, No Livestock, No Headquarters
- → Significant Stream Crossings – Included In Analysis
- Regionally Significant Fisheries Downstream of Access Route
- Streams Containing Regionally Significant Fisheries Below Escarpment to Lake Ontario (regionally significant portion not shown)
- ▨ Rural Residential Cluster (Hamlet)
- 15 plus Residences (Within 1Km)
- Urban Area (Vineland)
- Highway Commercial
- Development Application
- ▨ O.P. Residential Designation – Approved In Principal
- 800 Meter Boundary
- Candidate Site Boundary
- Access Road

Major Features Along Access Road Options

mile 1 0 1 2 miles

metres 1000 0 1 2 3 kilometres

MAP 2